ELECTRICAL REVIEW

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Electrical Exports

"Targets" and Actual Achievements

A GIGANTIC and manifold task is being carried out by the electrical industry and in spite of all handicaps is being carried out very well. First it has to meet the needs of the industries on what is known as the Prime Minister's List (P.M.L.) which include the coal mines, railways and electricity supply. Secondly it has to provide the electrical equipment which is incorporated in or attached to machinery exported by other branches of industry and in the third place it is called upon to export as much as possible directly. If after this there is a surplus, presumably the home market gets it.

Effect on Other Industries

The Board of Trade has looked upon the electrical manufacturing industry as an outstanding contributor to the desired increase in exports and has perhaps not had sufficient regard to the possible effects upon other export branches of shipping electrical equipment overseas. It is far better to supply motors to British manufacturers for incorporation in larger machinery with considerable total value—indeed it is essential if this machinery is ever to be exported. Lately the Board of Trade has come to a better appreciation of this and, we are told, has expressed willingness to credit the electrical industry with such incorporated equipment as part of its export total.

In the meantime direct exports by the industry continue to mount. The figures for September published in this issue complete three quarters of the year. In this period exports of electrical goods and apparatus had a total value of £35 million which compares with £26 million in the corresponding period of last year and £10·2 million as three-quarters of the 1938 figure. Machinery exports were put at £18·1 million against £9·4 million in January-September, 1946, and £7·3 million as three-quarters of the 1938 exports. The total value of exported electrical equipment and machinery was thus over 300 per cent of the 1938 figure and about 150 per cent of the amount for the first nine months of last year.

It is interesting to compare these results with the targets put forward by Sir Stafford Cripps at his meeting on September 12th. Sir Stafford gave the monthly average exports of electrical machinery in the last quarter of 1946 as £1·62 million; the targets were £1·915 by mid-1948 and £2·085 million by the end of that year. This year's monthly average has been £2·012 million so that the first target has been "overshot" already.

Increased Cable Shipments

Wire and cable exports were at a monthly average of £0·90 million in the last quarter of 1946 and this was given as the target for the whole of 1948. So far this year the monthly average has been £1·06 million. Radio manufacturers were set a 1948 target of £1·0 million per month, including valves (against £0·93 million per month in the last quarter of 1946). Actually the monthly average attained in the first three quarters of this year was £0·81 million.

As regards telephone and telegraph

apparatus exports, which averaged £0·46 million per month in the last quarter of 1946, the target set is £0·60 rising to £0·65 million. The monthly average during the first nine months of this year was £0·53 million. Electric lighting apparatus (including lamps) reached an average of £0·33 million per month in the last quarter of 1946 and the amounts stipulated are £0·45 million by mid-1948 and £0·50 million by the end of that year. Average monthly exports so far this year have been £0·35 million. Batteries and accumulators are expected to reach a monthly average of £0·25 million next year, the 1946 last-quarter average having been £0·24 million. The figure for this year has been £0·27 million (including parts and accessories). Other unspecified products are expected to run at an average of £1 million during 1948, giving a total of from £4·2 to £4·3 million, the latter figure being 215 per cent of the 1938 total.

It seems as though all the targets have already been reached or are easily attainable and that, given the necessary additional material, the industry will be fully able to meet its other vital tasks.

A Welcome Pronouncement

MR. GAITSKELL'S first statement in the House of Commons as Minister of Fuel and Power contained sound sense. Replying to an attack on the " secrecy " of the National Coal Board he expressed the view that the nationalized industries must be free from day-to-day interference by the Minister. Such action would produce just that kind of bureaucratic paralysis which it was the whole intention of the Coal Nationalization Act to avoid. As this is exactly the attitude we have adopted with regard to the nationalized electricity supply, we are naturally pleased to have Mr. Gaitskell's assurance. Moreover we do not fear excessive indulgence in " secrecy " on the part of the British Electricity Authority which so far has kept us well acquainted with its proceedings and intentions. That is why we want to see it getting on with its job free from unnecessary Ministerial interference.

Gas Nationalization

AFTER the taking over of the coal and electricity supply industries gas is now down for imminent nationalization. No doubt the Bill has already been drafted and it goes without saying that the reorganization will be on a regional basis as in the cases of coal and electricity. This arrangement was recommended by the Heyworth Committee of Enquiry which reported in 1945 and proposed ten regions, Scotland being one. No central authority was recommended; instead each regional board was to be autonomous and self-contained. Company undertakings were to be acquired at market value and municipal concerns either on an " output standard " valuation or on net outstanding debt. Mr. J. R. W. Alexander, general manager of the British Gas Council, has declared the industry's determination to oppose nationalization. This is natural but opposition can only be directed towards securing the best terms; it is most unlikely that it will prevent the scheme's going through.

Generating Plant Cut

UNDER the White Paper cuts in capital expenditure only 2,750 MW of new generating plant is to be provided within the next two years instead of the 3,100 MW budgeted for by the Central Electricity Board. Thereafter extensions will be limited to 1,500 MW per annum, so that in 1952 the total new capacity will be 7,250 MW in place of 8,773 MW as shown in the published programmes. We can see nothing in the cuts in expenditure in other industries that would warrant an expectation of anything approaching a corresponding drop in electrical demand below the original estimates, which in our leading article of October 3rd we showed to be the minimum necessary to maintain a reasonable standard of supply for homes and export industries.

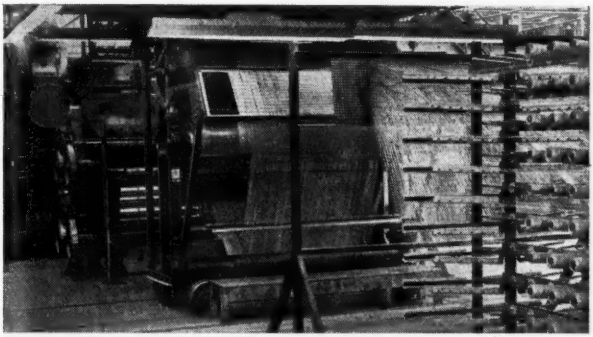
Letter and Spirit

IN his presidential address to the Association of Supervising Electrical Engineers, Mr. H. Nimmo explained that there was nothing in the 1947 Act to justify fears of political interference with the operations of the Area Boards or that local initiative would be discouraged. As he pointed out, the same men will largely be in effective control and that is what really matters, for as Mr. R. H. Rawll observed in his chairman's address to the I.E.E. Installations Section, the mere enactment of regulations does not necessarily get the desired result which is obtained only by willing compliance with the intention behind them.

Tyre Manufacture

Electrical Applications in a Large Factory

IN the *Electrical Review* of July 11th last we published " Modern Rubber Mixing," an illustrated description of the electrical applications to the initial mixing and milling process by which rubber is prepared as the raw material for the manufacture of various products, as we saw them carried out at the new Dunlop factory at Speke, Liverpool. In this article we describe the use of electricity in the production of outer covers for vehicle tyres of various descriptions, applications which involve some of the most advanced technique in driving the special class of machinery. By following the tyre production flow line it can be seen how the fabric which forms the basis for the structure of the tyre is prepared, and also the method of extruding the rubber tread.

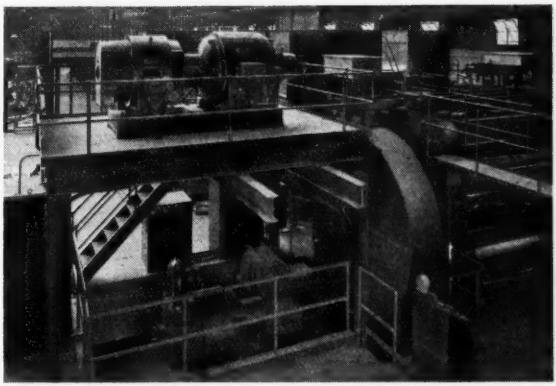


The cords pass over steam-heated driving drums as a continuous sheet

Further down the line the fabric is made into "pockets," then built into a tyre casing complete with wire beads and tread. Shaping and moulding of the tyre is followed by inspection and finishing.

Fabric for the tyre casings is prepared from weftless sheets of separate cords or sheets of either natural cotton or rayon. These sheets are prepared for tyre building by " topping " both sides with suitable rubber compound on a Bridge four-roll calender. The width of the fabric sheet varies according to the production requirements, and during the preparation of weftless fabric a creel carrying hundreds of spools of cotton or rayon cord is installed immediately in front of the calender. The individual cords are tensioned as necessary and guided through eyeplates so as to form a continuous sheet, and in this condition the sheet passes over steam-heated drying drums in order to drive off surplus moisture before the sheet passes into the centre nip of the calender.

Rubber compound in strip form is fed by conveyor from a line of warming mills into the roll nips formed by the two upper and the two lower sets of rolls, and in passing through these, films are formed on the two centre rolls which, in turn, transfer these rubber films to the fabric sheet passing through the nip of the two centre rolls. In

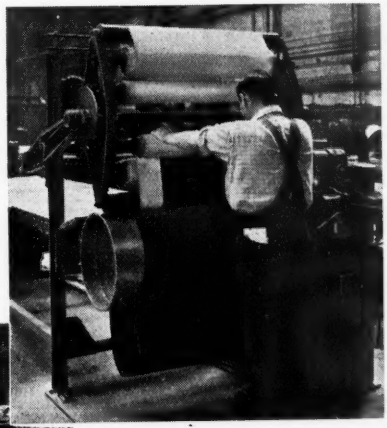


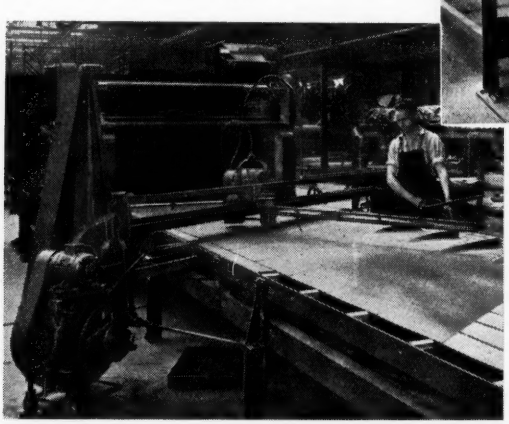
A 255-kW Ward-Leonard set supplies the 300-h.p. prepared-fabric calender motor

this manner the whole sheet is impregnated with rubber compound and is then ready for tyre building. The rolls of the calender are specially ground to compensate for roll deflection and ensure uniformity of film thickness.

The prepared fabric is passed over an automatic weighing machine and then over a tower of cooling drums, to be finally batched up into linings ready for cutting. An E.C.C. Ward-Leonard motor-generator set supplies the 300-h.p., 500-V, 1,000-r.p.m. calender motor which has a speed variation down to zero against constant torque, the horse-power falling with the speed. The set comprises a 255-kW, 500-V, shunt-wound generator, directly coupled to a 370-h.p., 5,000-V, 50-cycle, 1,000/970-r.p.m., slip-ring motor. For control of the 370-h.p., 5,000-V, motor driving the generator a standard stator cubicle and rotor liquid starter are used. The d.c. control panel is fully automatic and incorporates a motor-operated potentiometer rheostat in the generator field. The generator set also controls the motors which are used for feeding the cords through the drying and cooling drums, also the batching up of the fabric and linings. Any slight variation in the speed of the fabric passing through the calender is compensated for by means of a festoon arrangement. This operates a field regulator in the auxiliary motor circuit, which drives the cooling drums and batch-up gear. A slipping clutch mechanism controls the batch-up gear, this being essential owing to the ever-increasing diameter of the batch.

The calender rolls are adjustable in order that films of varying thickness may be deposited on the cords. The adjustment may be manual or through the motorized drive; either may be used, by the operation of a clutch, or remote push buttons in the case of the automatic adjustment. A separate remote control desk situated near the operator affords means of controlling the speed and direction of rotation of the calender motor and the speed of the batch-up motor. The motor driving the oil pump for the calender lubricating system and the 300-h.p. motor cooling fan are electrically interlocked so as to ensure that both are in operation prior to starting the calender drive.

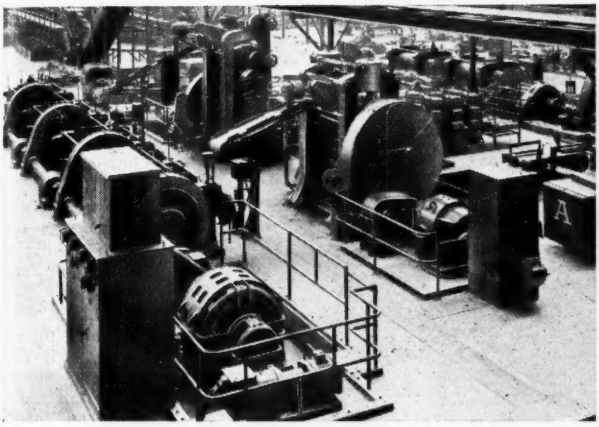




Left : Fabric, after being processed on the calender, is cut on the bias into strips
Above : Each pocket is built up of a number of prepared fabric strips

All the danger points on the calender installation are fitted with safety lines. Sixteen special trip switches with trigger latch releases and hand reset mechanism are installed. A slight pressure on the trip wire operates the switch which immediately stops the whole calender installation and indicates on a panel which trip has been operated. Thus no time is lost in getting to the danger point, and maximum protection is thereby ensured for the operators.

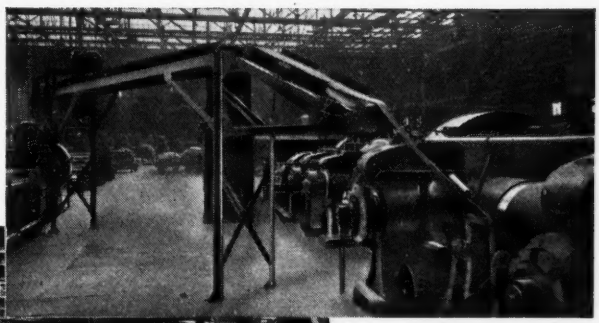
After being processed in the calender the fabric is cut on the bias into strips of widths

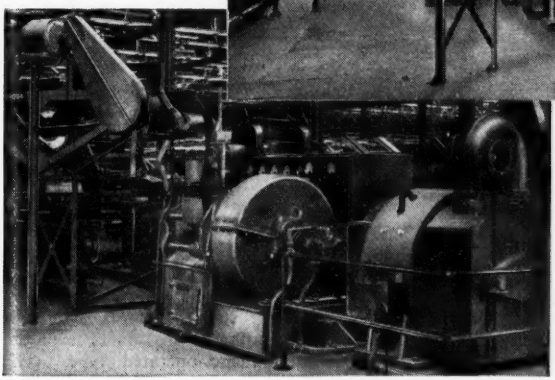


Insulation is prepared on three-roll and four-roll calenders which are fed from a line of four warming mills

such that the edges extend from bead to bead over the crown of the tyre. This machine consists of reel-off equipment, with tensioning bars, which feeds the fabric to the cutting conveyor. The rotary cutter is mounted on the automatic traverse, which is reversed by the operation of contactor equipment at the end of each stroke. The cutting off conveyor circuit is electrically interlocked so that on the return stroke of the rotating cutter the conveyor travels just sufficiently to allow another strip to be cut. The strips are laid on racks and taken to pocket-making machines. Here the fabric strip is formed into a pocket on an aluminium drum. Each pocket is built up of a number of prepared fabric strips with insulating compound between each layer. The insulating material is loaded on to the adjustable head of the pocket-making machine, which exerts a slight pressure on the fabric while the insulation is being applied. When the insulating film is being used its lining is rebatched on another roller.

In building the casing of a tyre an insulation medium is used between the layers of prepared fabric. This insulation is prepared on a 24 in. by 48 in. three-roll calender and an 18 in. by 36 in. four-roll calender, the calenders being fed by means of overhead conveyors from a line of four 60-in. warming mills. Each calender produces a film of insulating compound which is run on to rollers



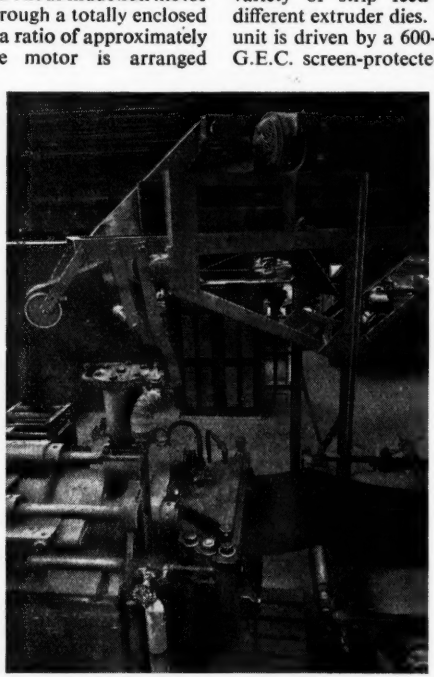


Above: On the final mill a mechanical device cuts off a strip of compound which is fed continuously into the throat of the tread extruder

Left: Bridge-National tread extruder driven by a 125-h.p., 250/1,000-r.p.m., d.c. motor

with a lining which prevents the adhesive film from sticking. A 300-h.p., 375-r.p.m., 400-V, 3-phase, G.E.C. synchronous induction motor drives the mill unit through a totally enclosed reduction unit having a ratio of approximately seven to one. The motor is arranged for separate excitation and dynamic braking. The control gear is of the air-break contactor type.

The 48-in. insulation calender is driven by a 110-h.p., 500-V, d.c., compound-wound E.C.C. motor, with a speed variation, effected by means of shunt control, of 500/1,500 r.p.m. The 36-in. insulation calender is driven by a similar E.C.C. motor of 60 h.p. with a speed range of 200/600 r.p.m. Each motor is controlled by a four-step contactor starter complete with two single pole, mechanically operated contactors for the dynamic braking circuit. The starting panels comprise a floor fixing sheet-steel cubicle, and are complete with starting and braking resistances, shunt field rheostat, and the necessary instruments.



Compounds are extruded through a die on to a gauging conveyor

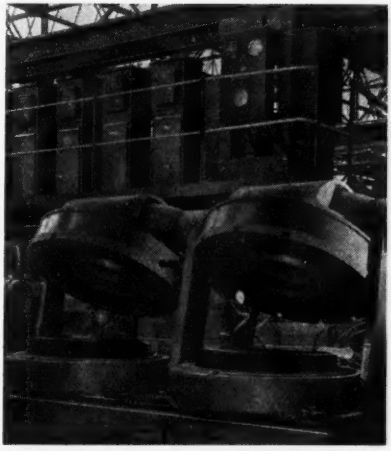
Running parallel with the preparation of the fabric is the manufacture of the tyre tread from the rubber compounds previously mixed in the Bridge-Banbury mixers. Before extruding the treads it is necessary to get the compounds back into a workable state, and for this purpose a line of three 84-in. mills and a 24-in. breaker are used. The cooled sheets are first put through the breaker which has two grooved rolls, and in this way the compound is prepared for the warming process which take place on the mills. On the final mill a mechanical device cuts off a strip of compound which is fed continuously into the throat of the tread extruder by means of a variable-speed overhead conveyor.

This conveyor is driven by an E.C.C. compound-wound d.c. motor, the variable-speed characteristic being essential due to the variety of strip feed speeds required for different extruder dies. The mill and breaker unit is driven by a 600-h.p., 375-r.p.m., 5-kV, G.E.C. screen-protected synchronous induction motor. For the purpose of providing a d.c. supply for separate excitation and also for dynamic braking in order to stop the motor in 4½ revolutions, a separate exciter motor generator is installed. The stator control unit consists of an interlocked boiler plate cubicle of the stationary pattern, with an externally operated isolating switch, and a triple-pole manually closed oil circuit breaker. An air-break contactor control equipment controls the rotor circuit. The starting equipment is contained in a totally enclosed cubicle, with auxiliary equipment for the generator set. On the front of the panel is mounted the exciter field regulator, power factor indicator and the voltmeters and ammeters for the stator and exciter circuits. Standard overload protection with oil dashpots, and a single-pole direct-acting earth-leakage trip coil, together with a no-volt coil and the necessary contacts for interlocking with the contactor gear, are incorporated in the stator circuit.

The tyre treads are extruded by machines of both Dunlop and Bridge design and a Bridge-National extruder is driven by an E.C.C. 125-h.p., 500-V, compound-wound d.c. motor with a speed range of 250/1,000 r.p.m. obtained by means of shunt control. Mounted on top of the motor frame is a 400-V, 3-phase, 50-cycle, motor-driven fan to ensure efficient ventilation of the main motor. The motor control panel is of the multiple step rachet-operated type. The

compounds are extruded through a die on to a gauging conveyor, and the tread is automatically weighed. The tread, after being weighed, is passed along the conveyor to the calenders where an insulating film of compound is superimposed. From this point the tread is conveyed through a water cooling tank, and then by means of a long overhead conveyor to the cutting-off table. The total length of the cooling conveyor is about 600 ft, and to compensate for the contraction of the tread while passing from one conveyor to the other, and to give the speed range required, the whole system is served by an E.C.C. Ward-Leonard set. Each calender is driven by a 15-h.p., d.c. motor while the gauging and tank conveyors are driven by 2-h.p. and 10-h.p., d.c. motors, respectively.

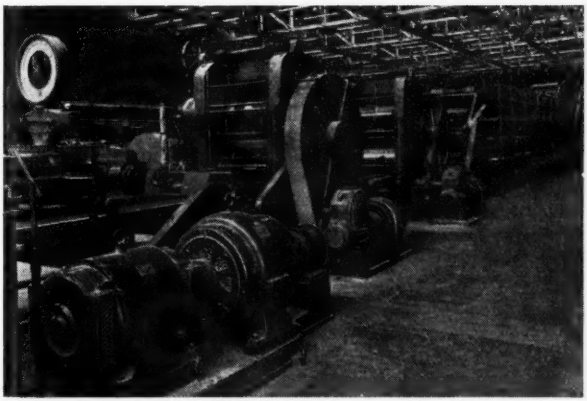
The Ward-Leonard set consists of a 54-h.p., squirrel-cage motor driving a 93-A, 380-V generator, with directly coupled exciter. By this means a speed range of 1,400 r.p.m. to 350 r.p.m. is provided for all these motors. The contactor panel for controlling the d.c. circuits has a main generator field regulator mounted on the front, and four field regulators to give final control to each motor. The speed indicating system employed comprises a transmitter directly coupled to each motor, and a separate indicator for each



Dual press for moulding car tyres

operated cutting-off table cuts it into the required lengths in a continuous operation through a festoon arrangement. The treads, together with the pockets, fabric fillers, chafers and head wires, are brought together at the tyre-building machine and assembled into the uncured tyre ready for shaping and moulding. The tyre building machine is essentially a variable-speed one, and must be capable of constant inching and reversing. For this purpose a 3½-h.p., d.c., compound-wound, dual-voltage machine is used, complete with air-break contactor switchgear.

Various methods are employed for shaping the casing from the flat condition as built on the tyre-building machine, into the actual tyre shape. A vacuum shaping machine comprising a hydraulic ram operating in a cylindrical chamber, the top portion being hinged, is used for some of the larger tyres. The machine is opened to allow one bead of the casing to seat on a rim which is formed on the top of the ram. When the machine is



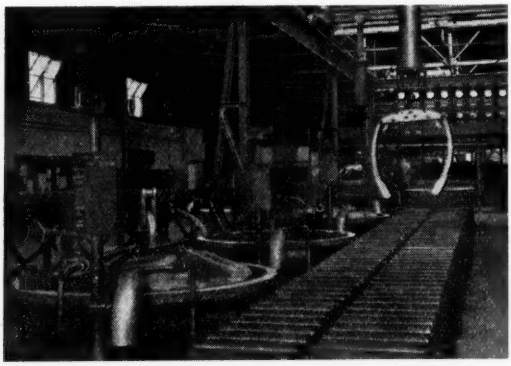
The tread is passed along the conveyor to the calenders ; the 15-h.p. calender motors are supplied by a Ward-Leonard set

conveyor and calender is calibrated in feet per minute.

When the extruded tread reaches the end of the cooling conveyor, an electrically

closed the other bead seats on a corresponding rim in the cover. The hydraulic ram is then operated and a vacuum is applied to the sealed chamber, this function performing the shaping operation. At this stage a rubber bag is inserted into the tyre to act as a core during the moulding period.

To mould the larger tyres each one, complete with its bag, is inserted in a split mould. The mould passes along a conveyor to a closing press, and is then lifted mechanically on to a gravity runway system. The gravity conveyor maintains a supply of moulds to the autoclaves which accommodate a number of moulds at a time. The moulds are lifted off the conveyor and loaded into the autoclave by a pneumatic lifting device. Inside the autoclave is a hydraulic ram which, when operated, applies a pressure to the moulds, thus forcing them together against the cover. A tree system of connections is made inside the autoclave, thus connecting all the bags to the steam and air services. The process is controlled electrically from panels which are located on a platform adjacent to the autoclaves.



Autoclave processes are controlled electrically

When the autoclave is loaded the control panels take over the operation and automatically control the admission of steam into the autoclave, steam and air into the curing bag in correct sequence, exhaust the autoclave and bag at the completion of the process, and fully safeguard the hydraulic, steam and air services during the moulding period. Temperatures and pressures operating during the moulding cycle are recorded by the panels. The process timing device comprises a synchronous motor driving a cam designed to operate relays in the required sequence and control the pilot operated valves. For moulding car tyres a dual press is used. This is mechanically operated and driven by a 7½-h.p., s.c. motor, and when loaded is closed by means of a push button. On closing, the automatic control takes over. A drum fitted with adjustable contacts driven by a synchronous motor controls the cycle of operations through pilot-operated valves, and admits steam and air at predetermined periods, exhausts and automatically opens the press and ejects the moulded tyre at the end of the moulding cycle.

We are indebted to the Dunlop Rubber Co., Ltd., for permission to visit the factory and to publish this article, and to Mr. D. Crabbe, chief engineer, and his staff for their assistance.

Marine Turbines

Wallsend Research Station

THIS year's Andrew Laing lecture of the North-East Coast Institution of Engineers and Shipbuilders was delivered by DR. T. W. F. BROWN (vice-president) who described the marine turbine testing (full scale) and research station established by "Pametrada," or to give it its full name, the Parsons and Marine Engineering Turbine Research and Development Association.

The lecturer outlined the layout of the riverside site at Wallsend-on-Tyne and the arrangement of the main testing, boiler and pump houses, together with certain permanent items of testing equipment they contain. Machinery installed was tabulated, purpose and maker being indicated, including electrical and electronic instruments.

The work being undertaken by this establishment could not be done on an appropriate scale by any university or technical college and is beyond the scope of individual manufacturing firms; hence the need for collective effort, which is supported by nineteen turbine makers at the shipbuilding centres.

The Association is controlled by a Council composed of the senior directors of the member firms with representatives of engineering and research sections of the Admiralty. The Association is grant-aided by the D.S.I.R. and is closely connected with the building side of the industry, which makes the prototype turbine machinery used for research and development by the Association.

Views on the News

Reflections on Current Topics

WHEN I read of the sinking of the London Power Company's collier *Charles Parsons* I felt what was almost a personal loss. How many times when walking along the Victoria Embankment have I seen the *Charles Parsons*, the *S. Z. de Ferranti* and the other ships named after electrical pioneers going up the Thames to Battersea or returning empty down river! What an excellent idea it was when the company decided upon this means of keeping the names of great electrical men before the public. One of the colliers bears the name of Sir Leonard Pearce, whose death was reported last week. The company was right in thus honouring its engineer-in-chief, but a more enduring memorial to him is the great Battersea power station for which he was responsible.

* * *

Only the most curmudgeonly will object to the floodlighting of Buckingham Palace on the evening of Princess Elizabeth's wedding day. It is a pity that circumstances do not permit a more general illumination on this occasion, and other national days. I refuse to regard more light as waste, being convinced that the easing of our spiritual gloom in this way more than counterbalances the small extra amount of fuel consumed.

* * *

The futility of some of to-day's regulations (albeit made in good faith) is commented upon by a correspondent to the *Manchester Guardian*. He has acquired a house but finds that the previous occupant has exhausted his coal allocation and so the premises may have no more just yet. The correspondent has a stock at his old house but may not move it. Decorations to the newly-purchased house will cost £150, but to get a licence he must put in a price of £99 10s. The decorator cannot get hold of reliable materials unless he has a W.B.A. permit, to obtain which he must have a council housing contract. He can then order enough to cover both the contract and the correspondent's job. The writer wishes to fix up an apartment for a young couple, with a cooker. He has been told by the local supply authority that any addition to its load cannot be countenanced but what he does without the authority's knowledge is his own business. It may be anarchical to say so but all this seems to show that it is absurd to try to overcome human nature by controls which apparently are easily circumvented.

* * *

Many men leaving the Services rightly held rosy views on the future of the electrical industry and decided to enter it if possible. Though not all of them were competent, there were good numbers who were quite capable of starting up as electrical contractors. But for all their ability, they have found great difficulty in carrying on, for if they have secured orders they have been hard put to it to find the materials for carrying out the work. One effect, I am told by Mr. F. W. Purse, hon. director of the National Register of Electrical Installation Contractors, has been a slowing down in the rate of applications for registration. This, coupled with the defection of E.C.A. members, has naturally affected the Register's finances, but this has spurred the Registration Board to increased efforts in this worthy cause. Not all E.C.A. members have withdrawn and, of course, the E.C.A. of Scotland still supports the Register.

* * *

In the history of electrical developments on the north-east coast, individual names stand out. Their work, which has fundamentally influenced electricity supply throughout the world, would have fallen short of their high aims if they had not been able to inspire their staffs with the same enthusiasm for technical advance. The present generation are heirs to a grand tradition which from my recent observations they worthily uphold. In the impending changes it will not be enough for them to feel that their financial position is secure. They will also want opportunities similar to those allowed their forebears to find an outlet for their ingrained experimental and progressive habits.

* * *

The Southend sirens came into action again, for the first time since the war, on October 21st to warn the public to cut down its electricity consumption. The consumers were so startled that the load went down by 2,500 kW in three minutes. Many, no doubt, automatically took to their shelters.

—**REFLECTOR.**

Sewage Disposal

Colne Valley Pumping and Treatment Works

THE disposal works of the Colne Valley Sewerage Board have been designed to receive and treat by the activated sludge process sewage from an ultimate population of 450,000, the maximum rate of flow allowed for being 240 gallons per person per day, the whole of which will have to be pumped.

The works at Maple Cross near Rickmansworth, Herts, will eventually supersede some twenty-four existing disposal plants and several existing pumping stations, ultimately serving twelve local authority areas, including St. Albans, Hemel Hempstead, Watford, Bushey, Chorleywood, Potters Bar and Ricksmansworth, together with considerable parts of the adjoining rural districts. Some of the 45 miles of trunk sewers needed are already installed and others are being laid.

The Board's consulting engineers are Sandford, Fawcett & Partners, Westminster, who recently arranged a visit to the site to enable members of the constituent authorities and representatives of Government Departments interested to inspect the constructional work, now resumed after wartime suspension.

Power Plant

All the power needed for operating the works and pumping stations will be generated on site; the power house carcase is almost complete and erection of the plant has just begun. The initial demand for 3,000 kVA will grow to nearly 4,500 kVA and will be furnished by five (ultimately six) 750-kVA engine-alternator sets made by the National Gas & Oil Engine Co., Ltd., and Crompton Parkinson, Ltd.

The engines are designed to run without modification on either methane gas or fuel oil, each being capable of 953 b.h.p. for one hour when supercharged (net output after deducting ancillary power required for pressure charging). The engine exhausts will provide high-grade heat for warming the buildings, while a lower grade will be available for sludge heating by circulating the engine cooling water at approximately 130 deg F through coils inside the digestors. An oil-fired boiler will supplement the heating systems, if necessary.

Generation will be three-phase at 3·3 kV; some of the motors will operate at that voltage and others at 400 V, the higher voltage switchgear being of Ferguson, Pailin manufacture and the lower of George Ellison make with Watford contactor gear. In the power house will be a large control board with mimic diagram indication of liquid flows, pump speeds, positions of valves, etc. The power house will also contain a bore-hole pump for furnishing fresh water and three (ultimately four) Reavell turbo-compressors for the aeration tanks, each of 320 h.p. and driven by three-phase 3·3-kV Crompton Parkinson motors.

The principal pumping station, at Juniper Hill about 1·5 miles north-east of the site, will force 90 per cent of the sewage through a rising main to the treatment works. It will contain nine 27-h.p. dry weather flow and four 75-h.p. storm water pumps driven by 3·3-kV motors. The former will operate at 500 or 750 r.p.m. under Evershed & Vignoles "No Float" control actuated by varying sump levels. This station will be entirely automatic, not staffed.

Two smaller pumping stations, at Maple Cross and about a mile north-west at West Hyde, will lift sewage from the Chorleywood and Misbourne Valley areas, not served by the Board's trunk sewers. The former will contain three 30-h.p. and the latter five 20-h.p. vertical pumps, under automatic control.

Central sludge pumping at the disposal works will be by eight electrically driven pumps for different purposes; four 7·5-h.p. vertical double ram variable stroke type and four horizontal, capable of operating in parallel pairs and automatically controlled, two of 27·5 and two of 75 h.p. each.

Sedimented sludge will pass to digestion tanks, heated by the engine cooling water as before mentioned and fitted with Dorr-Oliver stirrers and floating gasholders to collect the methane for driving the power house engines. The sludge disposal plant will need 520 h.p. for various types of pumps, including 30-h.p. motors for three vacuum pumps, sludge and coal pulverizers, conveyors, fans, air compressor, lift and motorized valves, etc. Some 60 motors will consume 6,200 kWh daily, derived from the 3·3-kV ring main from the power house to the Juniper Hill pumping station and the fertilizer-making plant.

Fertilizer Manufacture

The latter will be manufactured by the Dorr-Oliver Co., Ltd., whose associated concern has installed plant of the same kind in the United States. The disposal process will, it is claimed, be the first of its kind in Great Britain. Digested sludge will be elutriated with effluent in two stages, conditioned with chlorinated copperas (produced by treating ferrous sulphate solution with chlorine gas), passed to Oliver drum vacuum filters, and flash-dried in Raymond plants.

The orthodox general equipment is to be driven by 400-V motors, served by feeder cubicles erected about the 40-acre site, while the works roads will have modern street lighting.

We are indebted to Mr. H. W. G. Mitchell, mechanical and electrical engineer, for this information.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Non-Ohmic Resistors

I AM indebted to an article on "Ohm and His Law," by G.W.O.H. in the *Wireless Engineer* of October, 1947, for the following three points: (1) Ohm was born in 1789, not 1781 (various dates are given, but one may trust G.W.O.H.); (2) although Ohm did not use the term "resistance" in his 1827 treatise, and argued against it in 1829, he did use it (and Widerstandslänge, i.e., resistance-length, too) in an 1826 treatise; and (3) Ohm's Law was first published in another 1826 treatise, less elaborate and less mathematical than the 1827 one.

If I am to say anything on the term "non-ohmic," it would be this. Although Ohm's $S = A/L$ was formulated in pre-thyrite days, it is in fact a statement that S (current) is proportional to A (e.m.f.) *only when L (resistance) is constant.* If L varies, the relation between S and A varies accordingly; but at every instant $S = A/L$ remains true; and L can always be expressed in ohms as $L = A/S$ from moment to moment. Since "ohmic" means "measured by the ohm," to call thyrite "non-ohmic" seems to me to be of the same kind of ridiculousness as Humpty Dumpty's scornful dictum, "When *I* use a word, it means just what I choose it to mean—neither more or less."

As a purist, and not ashamed of it, I say that slackness about words is the kind of thing that causes wars and riots and all manner of mischief; and so it behoves us to be careful. Mr. Turnbull's reference to Whitehead is quite irrelevant; for what those who like the term "non-ohmic" have done is not christening, but declaring that that which, for example, is "red" may be called "not-red," or that that which is "black" may be called "white": which is (or seems to me) absurd.

The term "non-linear resistor" is almost as poor as "non-ohmic"; for it is not the resistor itself that is "non-linear," but its volt-ampere characteristic. Further, "linear" may apply to straight and non-straight lines, and therefore "non-linear" does not mean "non-straight," but rather "something that has nothing to do with lines." The adjective should be "non-rectilinear," and the complete term might be "non-rectilinear-volt-ampere-characteristic resistor." This is a mouthful that no one will emit; it might be shortened to "norvac" from initials; one of my colleagues has used "bent-characteristic resistor," and I like it as a description. Steinmetz used the alternative terms "pyro-electric conductors" or "pyroelectrolytes" in his *Theory and Calculation of Electric Circuits*, of date 1917; and Mr. Wells has proposed "voltage-dependent resistors." All this suggests that it would be easy to choose some term so much better than "non-ohmic" that it would readily replace it. Failure to do so reminds me of the slothful man in the book of *Proverbs*, who excused his sloth on the ground that there was a (quite imaginary) lion in the street.

Newcastle-on-Tyne. THOMAS CARTER.

MR. TURNBULL has not answered my letter dated October 10th on the point of stability, neither has he produced an authoritative version of Ohm's Law expressed in terms which justify the use of the disputed phrase "non-ohmic resistors."

It appears, however, that Mr. Turnbull has only now acquired precise knowledge of these resistors and I must respectfully point out that in the rectifier branch of the industry we have had this knowledge for over twenty years, and have applied it in the form of surge absorption resistors which will be found connected across all inductive parts of the circuit which are liable to develop voltage surges due to the high rates of current change associated with the commutation process.

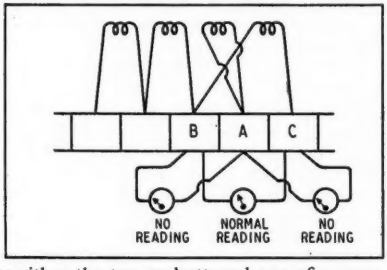
Although we have been using these resistors for such a long time we have never seen fit to call them "non-ohmic," and if as Mr. Turnbull suggests the term has come to stay, it will remain as a memorial to our own ignorance as to the true meaning of a law which has been described as "the backbone of electrical engineering."

Walton-on-Thames. ROBERT WELLS.

Armature Drop Testing

IN your issue of October 17th, Mr. H. Bloch says that a crossed coil is detected by a growler and asks for an explanation. If he was referring to the type of cross connection shown in Mr. S. F. Philpott's

sketch, it is difficult to see how this can be so. There is, however, another type of cross connection which, in my opinion, is much more likely to occur with a former-wound armature and can be so detected. It is caused by crossing over two adjacent wires



in either the top or bottom layer of connections at the commutator segments and is shown in the accompanying diagram for a lap winding.

The result is that one armature coil is closed on itself and connected to only one segment (shown as A). This coil and segment have no connection with the rest of the winding. In the growler test this closed loop will behave like a short-circuited coil and may be detected in the same way.

The wrong connection may also be located by the drop test and by a pair of test leads with a lamp in series. If the test leads are applied to the isolated segment and any other segment the lamp will not light up.

The results of a drop test are shown in the sketch. No reading is obtained between the isolated segment A and segments B and C, but a normal reading is obtained between segments B and C, the segments next to A.

If this cross connection occurs in a wave winding the numbers of isolated coils and segments in the closed circuit are each equal to half the number of poles, and the segments are equally spaced around the commutator. In the growler test this closed circuit will show up in as many slots as there are poles on the machine.

Bradford. C. HARGREAVES.

Instrument Design

THE surprisingly slender means available for making electrical measurements were commented upon by MR. D. C. GALL (H. Tinsley & Co., Ltd.) in his address as chairman of the Measurements Section of the I.E.E.

Whatever the origin of an instrument, the designer concerned was possessed of a stock-in-trade of methods which he attempted to apply to varying needs. He did not invent those methods; most of them were based on well-known physical effects and only when stock methods failed to satisfy requirements must the designer show genius and produce something new in principle.

Only two quantities directly indicated their presence; they were the magnetic and dielectric fields and whatever was to be measured must be made to affect one or the other of those. The measurement might appear to be simply one of current or voltage, but it was amusing to reflect that neither could be measured; all one could do was to infer their values from the force exerted by a field, involving the conversion of electrical into mechanical energy.

It was really astonishing that out of such minute forces, the endless range of measurements and the extremely high precision now obtainable should have been developed. A great debt was owed to the National Physical Laboratory for keeping the standards needed for calibrating purposes. It was not sufficiently appreciated that the instrument industry, as it was to-day, could hardly exist without the N.P.L. The change in absolute units which was to be introduced on January 1st, 1948, would involve differences of as much as four parts in ten-thousand in some units, so that calibration of that order of accuracy would need revision. In keeping with the times, the ohm, volt and watt would be smaller !

Mr. Gall proceeded to consider the relation between the energy used in a measuring system and the accuracy of the determination. The enormous ratios between the power dissipated in the system and that available for measurement were characteristic of any measuring system in which the precision was increased by some form of electrical circuit balance. Efficiency, as usually defined, fell as precision increased. Because there were practical limits to the amount of energy that could be dissipated in the system, accurate measurement required a very sensitive detector of small values. That was one of the greatest needs in electrical measurement.

Use of electrical amplification was a milestone, but the final system had not yet been evolved. Electronic methods had made many difficult things easy and the stabilization of testing circuits was an outstanding advance. Amplification ran right through all the fabric of their work, but electronics was said to be a disease; it was easy to waste an incredible amount of time on such circuits. Out of them, sooner or later, would emerge contrivances needed by instrument makers for their work, which indicated very accurately the trends by which big industries could be judged.

N.E. Coast Activities

Meeting of the N.E.S.C.O.E. Association

THIS year's meeting of the North-Eastern Electric Supply Company Old Employees' Association was held at Newcastle-on-Tyne on October 23rd and 24th. The first item on the agenda was a visit to the 200-MW Dunston B power station which, although started up fourteen years ago, is in the first four for thermal efficiency and in advance of newer ones. The boilers, 130,000 lb per hr each, are smaller than are going in nowadays, but foundations for extensions intended for next year's commissioning make provision for two 410,000-lb boilers with the same steam conditions of 650 lb per sq in and 800 deg F. The two new 50,000-kW turbo-alternators will embody interstage steam-reheating which is regarded as having justified itself in the older units.

At the annual dinner the chair was taken by Sir Arnold B. Gridley, M.P., who had been elected president in succession to Mr. R. P. Sloan, whom ill-health prevented from continuing to act. Proposing the toast of the North-Eastern Electric Supply Co., Sir Johnstone Wright (chairman, C.E.B.) remarked that this was probably the last meeting of the Association during the existence of the company as such. He hoped the change would not interfere with continued electrical progress and that the personal touch would not be lost. Electricity supply development everywhere owed much to the work of individual pioneers on the N.E. Coast, which had given the grid its foundations.

Industry's Traditions

Responding, Lt. Col. E. H. E. Woodward (managing director, N.E.S.C.O.) said he believed that freedom for invention and progress would remain under the new dispensation which would provide very much the same leadership as now. The old traditions would remain, and he had no doubt that membership of the Association would continue to grow. Mr. V. A. Lambert (Director-General of Munitions, Ministry of Supply), referred to the N.E. Coast as the training ground of many front-rank engineers. Sir Arnold B. Gridley, who recalled his connection with the undertaking as general manager of one of its component companies—the Cleveland & Durham, presented the Barrs silver bowl to Mr. J. N. Waite, as captain of the old boys' golf team which had earlier in the day scored a narrow victory over the representatives of the present staff.

Proposing the health "Our Guests," Mr. J. Hacking (vice-chairman, British Electricity Authority), who claimed twenty-six years' service with the company and its consulting engineers, Messrs. Merz & McLellan, spoke of the sympathetic attitude of the new Authority in allaying anxieties of staffs about their future. He paid a tribute to the part played by Parsons and Reyrolles in furthering electrical developments on the N.E. Coast.

Mr. H. A. Towers (director, Reyrolles) in acknowledgment, expressed the hope that under the B.E.A. the same type of engineer and progressive thought symbolized by the Association would continue. Sir Claude Gibb mentioned the amendments he had been able to introduce in the 1947 Bill during its passage through Parliament, which had materially improved the prospects of staff members, especially with reference to their pensions.

On the following day visits were paid to the works of Reyrolle and Parsons. Great activity was noticeable at both and conversion from war work appeared to be quite complete with machines largely set on the skew to save space. In addition several new buildings are being erected, among which the Portal structure for turbine manufacture at Heaton is especially notable. During the past three years Parsons have turned out an average of 400,000 kW per annum and expect two years hence to have a capacity of 800,000 kW. Inspection was made of the experimental gas turbine (already described in the *Electrical Review*) from which data has been obtained to construct the larger sets now on order. Perhaps the best news was that provided by Sir Claude Gibb that operatives are working better and earning considerably more than ever before. Reyrolles are meeting heavy demands for the new vertical drop-down 11-kV, 150-MVA switchgear and contactor-type air-break 600-kV units. They are able to effect 25 per cent reduction in electricity demand through transferring about 30 per cent of the staff on to night shift.

Toronto Report

TWO main items in the 1946 report of the Toronto Electric Commissioners are street lighting improvements and the replacement of overhead lines by underground cables. The present lighting programme calls for a capital expenditure of about $2,000,000 and the work is being pressed forward. This cost, however, is dwarfed by the amount that would be required to remove all poles and overhead lines from the city streets (estimated some years ago at $115,000,000, representing ten times the capital cost of the existing overhead distribution system). A limited scheme relating only to primary lines was estimated to cost $24,000,000, still a formidable figure but one which the Commissioners consider might be met out of income if spread over a long period. A sum of $500,000 has been set aside for work of this kind.

PARLIAMENTARY NEWS

By Our Special Reporter

DURING the House of Commons debate on the address in reply to the King's Speech, Sir Stafford Cripps, the Minister of Economic Affairs, reviewed the steps necessary to deal with the present economic position. In the course of his speech he said that exports would have the first priority. Some goods had already been allocated exclusively to the export markets and they might well have to go further in this direction. So far as coal and power were concerned, the Government had planned to assure industry of its full requirements for the six winter months, but he emphasized that they could not succeed in their job unless domestic consumers of gas and electricity showed the very greatest restraint.

The main raw material with which they were concerned was steel. They were well on towards reaching their optimum target of 14 million tons, but even so they were two or three million tons short of their needs. Unfortunately the allocations by the steel control had become disorganized through too much being allocated. A Committee under the Paymaster-General had worked out a new scheme which would, they hoped, ensure that deliveries followed closely upon allocations. The job they had to do was to make about 1 million tons more steel a year available for exports than would have been used this year. That could not be done unless in addition to increasing our output we cut down our own investment programme.

The object of this curtailment of our capital construction programme was primarily to save steel, fuel and some dollar imports such as timber and at the same time to bring about a measure of deflation. They had come to the conclusion that as a first step the annual expenditure upon capital construction (all new building and the provision of new plant and machinery) must be cut immediately by £200 million. With regard to housing they had decided to provide for the completion, in the shortest possible time, of the 260,000 dwellings under construction and 90,000 more under contract. As to factories, they proposed to cut the programme to the extent required to save 30,000 tons of steel a quarter. This would mean for the present the starting of very little new building, but the progressive finishing of those factories that were already under way. Some factories which had not yet got their steel would have to be stopped for the time being unless they contributed to export or other very essential production.

Turning to industrial machinery he said that they would have to take more of this for export and to leave less for the home market. How best that could be done and which machines were of particular importance to industry to enable it to reach its export target could only be worked out section by section of the engineering industry, and that was now being done.

So far as the priority programmes were concerned they had re-examined the programme for coal machinery and for electric generating plant and apart from some trimming here and there the Government were maintaining the priority for these programmes.

New Bill

Mr. L. J. Edwards, Parliamentary Secretary to the Ministry of Health, presented the Local Government Bill, to "amend the law relating to Exchequer Grants to local authorities and other bodies . . . ; provide for payments for the benefit of local authorities by the British Transport Commission, the British Electricity Authority and the North of Scotland Hydro-Electric Board; amend . . . the law relating to the manner in which certain securities of local authorities and other bodies may be transferred . . ."

Export Inquiries

WE have received the undermentioned inquiries from firms and individuals overseas who wish to secure agencies for British electrical equipment and appliances or to import them into their territories. We shall be glad to pass on to them replies received from readers, which should be addressed to the Editors, quoting the number given in parentheses. We cannot vouch for the standing of inquirers and manufacturers replying to them will no doubt require the usual references:—

Australia.—A Sydney firm of manufacturing electrical engineers is anxious to get in touch with a British electrical manufacturer interested in commencing manufacturing activities in Australia. It deals almost exclusively in capital equipment, its manufactures being mainly switchgear. (X.192.)

Malaya.—A Singapore firm, at present dealing solely with radio, wishes to get into touch with manufacturers of domestic electrical appliances with a view to securing agencies for these. (X.193.)

S.E. London Technical Institute.—A course of ten weekly lectures on "An Introduction to X-rays, X-ray Crystallography and Metallography" will be given by Mr. J. W. Jeffery at the L.C.C. South-East London Technical Institute commencing on November 19th, and a course of ten weekly lectures on "X-ray Crystallography with special reference to Metallography," will be given at the Institute commencing on February 18th next.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Engineers' Guild has elected **Mr. D. B. Hoseason,** M.I.Mech.E., M.I.E.E., Director of Studies, at the Administrative Staff College, Henley-on-Thames, and **Mr. J. W. J. Townley,** C.B.E., M.I.E.E., engineer and manager of the West Ham Corporation Electricity Department, as members of the General Council.

Mr. L. B. Law has been appointed operation engineer for the South-West England and South Wales Area of the Central Electricity Board in succession to the late Mr. R. W. Biles. Mr. Law was previously senior assistant operation engineer and this position is now taken by **Mr. H. F. R. Taylor,** who was until recently second assistant operation engineer. **Mr. W. S. Wilson,** at present a member of the operation staff in North-West England and North Wales, is to be second assistant operation engineer, South-West England and South Wales Area.

Mr. V. J. Chalwin has been appointed director and joint general manager of J. & H. McLaren, Ltd., and general manager of Flathers & Co., Ltd., both associated companies of the Brush Electrical Engineering Co., Ltd.

Mr. F. H. S. Brown, B.Sc., A.M.I.E.E., A.M.I.Mech.E., has been appointed chief technical engineer in the Liverpool Electric Supply Department.

Mr. P. Steward, assistant mains engineer with the King's Lynn Corporation Electricity Department, has been appointed senior assistant mains engineer with First Garden City, Ltd., Letchworth. He takes up his new duties on November 20th.

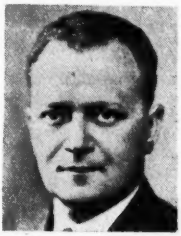
Mr. T. E. H. Birley, O.B.E., overseas representative of B.I. Callender's Cables, Ltd., was on October 16th presented with the American Legion of Merit degree of Officer by Major General Clayton Bissell, U.S. Military Attaché at the American Army Headquarters in London. The award was made in recognition of Mr. Birley's work as assistant secretary on the War Cabinet Secretariat in Washington from 1942 to 1945, where he served as group captain under Field-Marshal Sir John Dill.

The second annual dinner of the J. & P. Foremen's Association was held at Woolwich on October 17th. **Mr. G. Leslie Wates,** chairman and joint managing director of Johnson & Phillips, Ltd., was in the chair, supported by Mr. W. Glass, joint managing director, Mr. R. W. C. Reeves, a director of the company, and the committee of the Association. Among the guests were members of the J. & P. management, also Messrs. J. B. Dean, W. F. Randall, B. H. Musgrave, directors, and Mr. F. Leighton, works manager of the Telegraph Construction & Maintenance Co., Ltd. Mr. S. Simmons (chairman of the Association) coupled the name of the company with that of Mr. Wates in his toast of " The Chairman " and mentioned the close co-operation achieved during the past year as a result of the regular monthly meetings which the foremen had had with the departmental managers. Responding, Mr. Wates referred to the strong family spirit which existed in the company.

The first production of the M-V. Dramatic and Operatic Society for the 1947-48 season was " We Proudly Present," which was played to full houses at the M-V. Club Theatre from September 29th to October 1st. This comedy, by Ivor Novello, has only recently finished its West End run. Leading parts were taken by Barbara Trevor, Mary Matthias, Ann Buchanan, Justine Cavanagh, Brian Riley, Michael Fitzgerald and Harold Carter, and the Society's senior producer, Harry Matthias, came back into action with considerable effect.

Obituary

Mr. H. J. Allcock.—We regret to record the death, which occurred on October 24th, of Mr. Harold John Allcock, M.Sc., M.I.E.E., M.I.Mech.E., deputy manager (production) with British Insulated Callender's Cables, Ltd. Mr. Allcock, who was educated at Taunton School and the University College of South Wales and Monmouthshire, received his practical training as a college apprentice with the Metropolitan - Vickers Electrical Co., Ltd., for which he served as laison engineer with the Westinghouse Electric Co., East Pittsburgh, from 1924 to 1926. A year later he joined Callender's as technical assistant to the Cable Department manager. Subsequently he held the positions of assistant to the chief engineer, and process manager. In 1941 he organized the technical side of the cable industry to meet the Government's wartime requirements, and was the first chairman of the Cablemakers' (War Emergency) Technical Committee. In 1942 he took up duties with the M.A.P. as Director-General of Communications Equipment but resigned the next year owing to ill health. He resumed his duties with Callender's as controller of the northern factories in 1944. Following amalgamation with B.I. Cables he was appointed deputy to the production director of B.I. Callender's. Shortly before

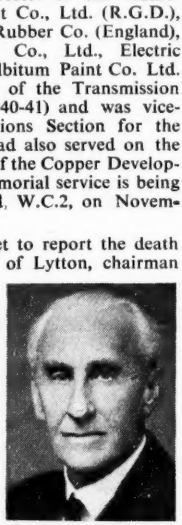


The late Mr. H. J. Allcock

his death he had, as deputy chairman of the Joint Committee on Practical Training in the Electrical Engineering Industry, been engaged in the preparation of the Committee's report which he was due to present as a paper to the I.E.E. on November 20th.

Mr. Allcock was a director of the Radiogramophone Development Co., Ltd. (R.G.D.), Rotunda Ltd., Steadfast Rubber Co. (England), Ltd., United Insulation Co., Ltd., Electric Panels, Ltd., and the Kalbitum Paint Co. Ltd. He was a past chairman of the Transmission Section of the I.E.E. (1940-41) and was vice-chairman of the Installations Section for the present session. He had also served on the Management Committee of the Copper Development Association. A memorial service is being held at St. Mary le Strand, W.C.2, on November 4th, at 3 p.m.

Lord Lytton.—We regret to report the death on Saturday of the Earl of Lytton, chairman of Central London Electricity, Ltd., London Associated Electricity Undertakings, Ltd., and the London Power Co. Lord Lytton, who was seventy-one, had held various Government appointments, including the governorship of Bengal. From 1938 to 1941 he was president of the British Electrical Development Association.



The late Lord Lytton

Mr. A. F. de Turekheim.—It is with regret that we have to record the death on October 19th of Mr. Alfred Frederick de Turckheim, at the age of eighty-four. Until his retirement Mr. de Turckheim was well known for his activities as secretary of the National Joint Industrial Council for the Electricity Supply Industry from its formation in 1919 until 1934, and as secretary of the Incorporated Association of Electric Power Companies and the Tramways, Light Railways and Transport Association (now the Public Transport Association Inc.).

Mr. J. Sim.—We regret to announce the sudden death on October 20th of Mr. James Sim, B.Sc. (Eng.), chief draughtsman of G. & J. Weir, Ltd., Cathcart, Glasgow. Mr. Sim served his apprenticeship with Fullerton, Hodgert & Barclay, Ltd., of Paisley, and after further experience with the Mirrlees Watson Co. in Glasgow, he joined G. & J. Weir's staff in 1909. His technical abilities were shown, in particular, in his work in the development of the Weir closed feed system and the Weir regenerative condenser in which he carried out much of the pioneering work and for which he had many patents to his credit. In 1924 he wrote the book "Steam Condensing Plant" and he had read many papers before engineering societies on subjects connected with boiler feed systems and equipment. Mr. Sim was sixty-three years of age.

Mr. W. Ferrer.—The death occurred on October 14th of Mr. W. Ferrer, divisional engineer for the Northern Division of the S.W.S. Electric Power Co. His thirty-four years' service with the company began at the Smethwick power station, followed by a period (1928 to 1938) as frequency change engineer, when he was responsible for carrying out standardization of frequency in the 25-cycle part of the company's area, including the heavy industrial area of Smethwick, Oldbury, Dudley and Halesowen. From 1938 until 1940 he was power consumers' engineer at the central office.

Mr. R. W. Young.—The death is also announced of Mr. R. W. Young, which occurred on October 14th after a long and severe illness. Mr. Young had been with the S.W.S. Co. and its associated companies for forty-four years. After a period with the Birmingham & Midland Tramways Co., he joined the S.W.S. Co. as substation installation engineer, and held this post until about 1935 when he was given charge of the Switchgear Construction Department in the company's workshops at Bromsgrove.

Mr. C. G. Cadman, M.I.Mech.E., M.I.E.E., late Engineer-in-Chief, Post and Telegraph Department, Malaya, died on October 22nd.

Mr. F. S. Hayburn, whose death occurred recently at Chiswick at the age of sixty-nine, joined the Marconi International Marine Communication Co., Ltd., in 1904. He was appointed assistant general manager in 1922, manager in 1925, general manager in 1927, director and deputy managing director in 1928, and managing director in 1933. At the end of 1935 he relinquished this position to become foreign envoy of the whole of the Marconi group of companies. He retired in 1944, but continued to act as a consultant until his death.

Mr. J. O. Clyne, A.M.I.E.E., A.M.I.Mech.E. —The death occurred on October 22nd at the age of sixty-five of Mr. Joseph Oliver Clyne, who was on the staff of the Metropolitan-Vickers Electrical Co., Ltd., for forty-seven years.

A memorial service for **Sir Leonard Pearce** will be held at Westminster Chapel, Buckingham Gate, S.W.1, at noon on November 4th.

Wills.—Mr. L. F. Spearing, personnel manager at the Blackburn works of Philips Lamps, Ltd., left £2,593 (net personalty £2,485).

Mr. P. E. Newnam, electrical engineer, of Eltham, S.E.9, left £5,000 (net personalty £4,958).

Lt. Cdr. H. T. Harrison, R.N.V.R. retd., senior partner of Nalder & Harrison, instrument makers, and technical adviser to the Electric Street Lighting Apparatus Co., left £4,454 (net personalty £4,397).

Housing the B.E.A.

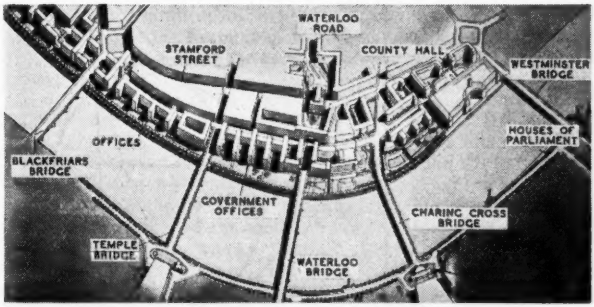
Suggestion for Future Permanent Offices

IT is hard enough for existing organizations to find accommodation for their expanding staff and activities. How much more difficult then is the task of discovering suitable premises for a new body. After much inquiry and searching the British Electricity Authority has been forced to take on inadequate premises in a not very suitable position and it will soon find that it is in need of further space. If this leads to the splitting-up of the staff among a number of widely separated buildings efficiency and co-ordination will suffer, but we are afraid this will be inevitable as a temporary measure.

There is little hope that the position in London will be eased within the next few years and unless by unexpected cuts in the Civil Service whole blocks of buildings are made available it seems that the new Authority will have to struggle under this handicap for a long time. So long indeed that it is permissible to look into the further future envisaged in the County of London Plan. It seems to us that whatever reconstruction there may be on the north side of the Thames pre-emptory rights exist which will bar the way to newcomers. On the south side of the river prospects are much more promising, for this district is "unfashionable" and considered somewhat remote, although the bridge crossings are easy and short. The County of London Plan provides for a very thorough development of the area which will make it as convenient and attractive as the Strand-Kingsway sector in which competition for buildings is now so acute.

The Portland Court premises of the British Electricity Authority

From the County of London Plan we reproduce a drawing of the improved south bank conceived by Sir Patrick Abercrombie. It will be seen from this that between the existing Waterloo Bridge and the projected Temple Bridge (which will be an excellent link with the other side) there is a block labelled "Government Buildings." We take the term "Government" to embrace any State organizations such, for instance, as the British Electricity Authority. Why should not the Authority put in an immediate claim for an adequate share of the new block? It has an excellent case for preference in this matter and such a claim might actually help to hasten the development of the area. We would go further than this and suggest that sufficient accommodation might be allocated to house other electrical organizations in close touch with the Authority.



Plan for the south bank of the Thames showing proposed Government buildings between Waterloo Bridge and the projected Temple Bridge

Women's Engineering Society

The Manchester Branch of the Women's Engineering Society recently visited the motion study laboratories at Heald Green of Miss A. G. Shaw. Assisted by her staff Miss Shaw who is a member of the Society, showed with the aid of practical examples and films how great economies in time and labour could be effected in anything from wrapping biscuits to typing and cotton spinning. By the rearrangement of material and tools and the addition of a few simple devices, a job could be speeded up, fatigue reduced and production stepped up.

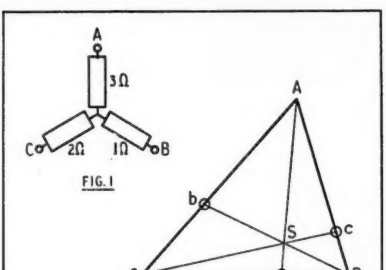
Unbalanced Impedance Star Network

New Graphical Solution for Impedances Fed from an Unsymmetrical Three-phase Supply

By E. Wilkinson, Ph.D.

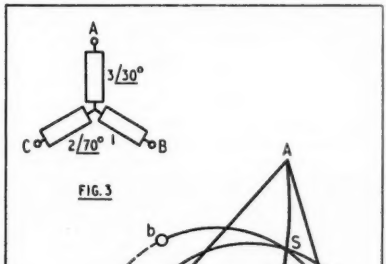
LITTLE has been published concerning the geometry of the three-phase voltage vector diagram, except to illustrate symmetrical component methods. Even the case of unbalanced star-connected resistances appears to have been incompletely understood, and required further consideration as recently as 1945.* The case of impedances of unequal ohmic value, Z_a, Z_b, Z_c and phase angles α; β; γ has apparently escaped graphical treatment altogether until now.

To introduce the construction for the general case, it may be well to reconsider the known graphical solution for unbalanced resistances, such as in the circuit of Fig. 1. The solution is constructed in Fig. 2, where the sides AB, BC, CA represent the vectors of the, here unequal, line voltages. The star point S is found by dividing BC at the point a, such that Ca/aB = 2/1; CA at the point b, such that Cb/bA = 2/3; and AB at the point c, such that Ac/cB = 3/1, and then finding the point of intersection S of the lines Aa, Bb, and Cc. This is illustrated in Fig. 2, in which the line voltages are taken as being



$_aV_b$ = 7 units; $_bV_c$ = 8 units; $_cV_a$ = 9 units. The phase-voltage vectors are SA, SB and SC.

This simple construction applies not only to pure resistances but also to any impedances of equal power factor. The star-point S would thus occupy the same position if the resistances were changed to reactances of the same ohmic value, but if even one of the impedances is different in type from the others then the construction must be considerably modified. In the general case the impedances have different ohmic values and power-factor angles. We may, however, change the ohmic values in proportion and add equal amounts to the power-factor angles, without altering the position of S. Thus the star point of the impedances 6/10 deg; 2/−20 deg; 4/50 deg will be the same as for impedances 3/30 deg; 1/0 deg; 2/70 deg. The ohmic values have all been reduced in the proportion of 2 to 1, and 20 deg has been added to each phase angle.



In order to consider the diagram for this general case, we may refer once more with advantage to Fig. 2. The line Aa clearly represents the locus of the star point S, if the resistance in phase A be made variable, while the other two resistances remain constant at 1Ω and 2Ω respectively. At A, the resistance

* "Unbalanced Resistance Star Network," by R. L. Russell, *Electrical Review*, May 25th, 1945 and correspondence, June 8th, 1945.

is zero and at a the resistance is infinite. Similarly Bb and Cc are locus diagrams for variable B and C resistances. It will be convenient to call a, b, and c " infinity points."

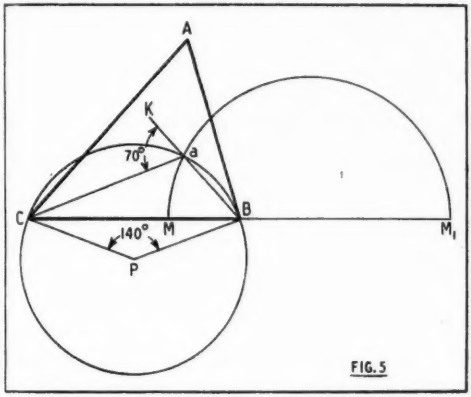


FIG. 5

Turning to the problem of the circuit diagram of Fig. 3 (an example of the general case), the ohmic values are the same as before but the phase angles are different. The infinity points, a, b, and c must obviously leave the base lines and (less obviously) the lines Aa, Bb and Cc become circular arcs. The latter statement may easily be verified in the general case by analytical means. In Fig. 4, the solution has been anticipated so that the principle of the method may be compared with the known method for resistances.

The locus circles may be drawn if three points on each of their circumferences are known, or alternatively if their centres and radii are known. Either method may be employed and alternative constructions are, in fact, possible. It should be noted that it is not necessary to draw all three circles, any more than it is necessary to draw all three lines Aa, Bb, and Cc in Fig. 2. Any two circles will suffice and the third may be drawn if desired, either for confirmation or when, with certain values, the two circles intersect at a narrow angle. In the latter case, the third circle makes the exact point of intersection of all three more definite. The three points may be found fairly easily. On the locus for Za variable, the point A is itself one of these. The infinity point a is another.

In Fig. 4, the arcs are continued dotted after the infinity points and are seen to meet at another point S_1, which is thus a point on all of the locus circles. At this point, the phase currents total zero for a selected ohmic value of any one of the impedances, with the other impedances unchanged. S_1 satisfies most of the conditions for the star point, but, although it is not the star point, it is the third point, which enables the locus circles to be drawn and the star point S to be found. Thus a knowledge of the position of A, a, and S_1 enables the locus for variable Za to be drawn. A knowledge of B, b, and S_1 enables the locus for variable Zb to be drawn, and the intersection of these two circles is the required star point S.

To Construct the " Infinity Point" a.—Supposing that the impedances are Za/α; Zb/β; Zc/γ, then draw CP (see Fig. 5) so that $P\hat{C}B = \frac{\pi}{2} - (\gamma - \beta)$, and BP so that $P\hat{B}C = P\hat{C}B$. Then $C\hat{P}B = 2(\gamma - \beta)$.

In the particular example of the general case here being considered $C\hat{P}B = 140$ deg. It should be noted that if $(\gamma - \beta)$ be negative, P must be drawn on the opposite side of BC. With centre P and radius PC = PB draw a circle. Divide CB internally and externally in the ohmic values in phases C and B. Thus $CM/MB = CM_1/M_1B = Zc/Zb$ (in the example 2/1). On

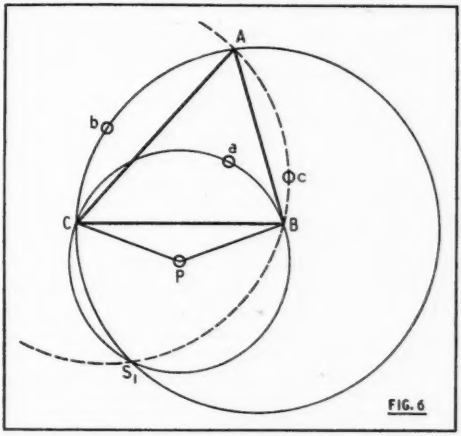


FIG. 6

MM_1 as diameter draw a circle to intersect the other circle at the point a. This is the infinity point (since Ca/aB = 2/1 and Cak = 70 deg, so that the phase currents in phases C and B cancel. That in phase A is zero.) Points b and c may be found similarly.

To Construct the "In Phase Point" S_1.—At all points on the arc of the circle of centre P and radius PC, an angle of 70 deg will be subtended by BC. Therefore, when the star point has the potential of such a point, the phase voltage Vb must lag behind Vc by 70 deg, and the currents in the C and B phases must be exactly in phase with each other.

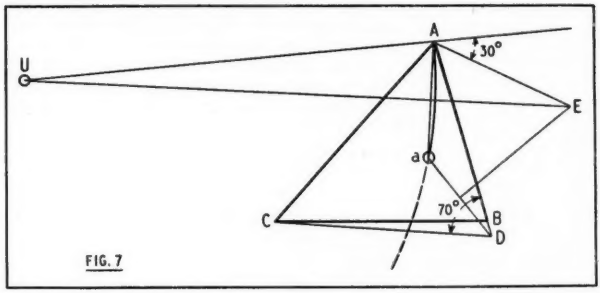


FIG. 7

In finding the point b, a circle of centre Q (corresponding to P for the point a) and of radius QA will have been drawn. Where this circle intersects the circle of centre P and radius PC, the currents in all three phases are in phase or phase opposition, and balance of the currents is possible for suitable positive or negative ohmic values of the impedances. This point, S_1, may conveniently be called the "in phase point." The determination of the position of S_1 is demonstrated in Fig. 6.

Completion of the Construction.—A circle is now drawn through the points A, a, and S_1. Another circle is drawn through the points B, b, and S_1. These circles intersect at S_1 and at another point S. The point S is the required star point. A circle may also be drawn through C, c, and S_1, and this will intersect the other circles at S.

Alternative Construction.—Draw CD to intersect AB at D (see Fig. 7) and so that CDA = $\gamma - \beta$ (i.e. 70 deg). Find E, the centre of the circle through A, a and D. Join EA. Draw a line through A to lead AE by an angle $\alpha - \beta$ (i.e. 30 deg). Let this line cut the perpendicular bisector of Aa at U. Then U is the centre of the locus for variable Za, and the radius is UA = Ua. The Zb locus may be found similarly, and the intersection of the two locus circles gives the star point. The analytical proof of this construction is straightforward, if somewhat tedious.

Particular Cases

1. *Unequal Pure Resistances.*—In this case, the three intersecting circles have all become circles of infinite radius, and the "in-phase point" is at infinity.

2. $\alpha = \beta$.—If any two of the phase angles, α, β, γ, be equal, the construction of one locus circle is much simplified. Thus if $\alpha = \beta$ then D lies at infinity and therefore the circle through A, a, D becomes the straight line Aa. The point a lies on BC. E must be at infinity, hence the line AE is parallel to the perpendicular bisector of Aa. The construction is simplified to drawing a line AU at an angle $\alpha - \beta$ to the direction of the perpendicular bisector of Aa. The point of intersection of the two lines is U, the locus centre.

3. *Unequal Impedances with equal Line Mutual Reactances* (*see Fig.* 8).—In this case each line has a mutual reactance M to each other line. The voltage of phase A is given by the vector equation Va = IaZa + IbM + IcM (where Ia, Ib and Ic are the vectors of phase current.) Since vectorially Ib + Ic = − Ia, then Va = Ia (Za − M). The constructions given above will thus apply if a simple star circuit of impedances vectorially equal to (Za − M); (Zb − M); (Zc − M) be used in the construction.

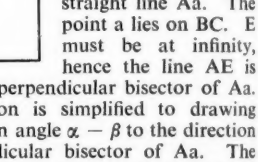


FIG. 8

Northampton Electrical Association

At the October monthly meeting of the Northampton and District Electrical Association Professor M. H. L. Pryce of Oxford gave a lecture on "Atomic Energy."

COMMERCE and INDUSTRY

Meter Certification. Power Engineers' Conditions.

AN Order in Council (S.R. & O. 1947, No. 2197) has been made revoking Defence Regulation 60CB (Suspension of Certification of Electricity Meters) with effect as from October 14th, 1947. It is now therefore obligatory for all electricity meters installed on the premises of ordinary consumers (other than meters to which Section 3 of the Electricity Supply (Meters) Act, 1936, applies) to be certified unless otherwise agreed.

Power Engineers' Agreement

In the *Electrical Review* of September 26th details were given of the agreement reached on September 4th by the National Joint Board for the Electricity Supply Industry relating to the hours to be worked by the technical staffs of electricity undertakings. The agreement, which has now been printed, provides *inter alia* that shift employees' hours are to average not more than forty-four a week over a six-month period. In this connection, it is provided that for shifts in immediate succession covering a period of every twenty-four hours undertakings are to allocate to each shift position five employees who will be responsible for maintaining the continuity of the shift notwithstanding absence due to holidays, accidents, illness, resignation, etc. Day employees' hours are normally to be the same as the undertaking's recognized office hours. For standby duties at his residence outside normal working hours an employee is to be paid £2 a week; unless otherwise agreed such duties are not to exceed the equivalent of one week in four.

Cable Makers' Holidays

Owing to amendments having been made to the Memorandum of Agreement for Statutory Holidays since it was adopted by the Joint Industrial Council for the Electrical Cable Making Industry in March, 1946, up-to-date reprints of the agreement have been prepared and copies are available on request.

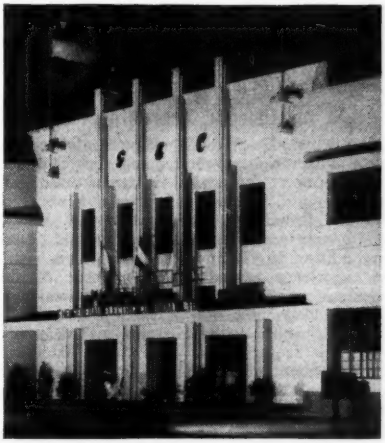
Atomic Research

The Ministry of Supply has issued a list of 98 reports dealing with atomic energy which are available from H.M. Stationery Office, P.O. Box 569, London, S.E.1, in the form of enlarged prints (9 in. by 7 in.) from microfilms at prices ranging from 8d. to 20s. 8d. Microfilms can also be supplied.

Indian Independence Day

Floodlighting of many buildings in various parts of India formed a feature of the celebrations which took place on India's Independence Day. The accompanying picture shows the Madras premises of the G.E.C. (India), Ltd., floodlighted by 125-W "Osram" high-pressure mercury vapour lamps in G.E.C. "Uniway" lanterns.

The new Bombay premises of the company were recently opened. These have a floor



Premises of G.E.C. (India), Ltd., Madras, floodlighted for the Independence Day Celebrations

space of 24,000 sq ft and accommodate a staff of 105, of whom six are Europeans. The works attached to the branch employ 326.

Reports from Germany and Japan

Hitherto inquiries about German and Japanese reports in the B.I.O.S. series have been directed to B.I.O.S. at 32/37, Bryanston Square, W.1, and applications to examine original German documents have been addressed to Documents Unit, German Division, Board of Trade, Lansdowne House, Berkeley Square, W.1. With a view to centralizing the work and offering an improved service to industry on both reports and documents, these two units are being integrated as from November 3rd and will be known as: Technical Information and Documents Unit, German Division, Board of Trade, 40, Cadogan Square, S.W.1. H.M. Stationery Office sales offices are still the only source from which copies of B.I.O.S. publications can be purchased.

Among recent reports on German industry are the following (copies are obtainable from H.M. Stationery Office) :—B.I.O.S. 1562, "German Laboratory Instruments Industry" (11s.). F.I.A.T. 617, Supp. No. 1, "Electrical

and Technical Ceramic Industry of Germany. Supplementary report: High Dielectric Constant Insulators " (2s.). F.I.A.T. 687, " B.M.W. Passenger Car and Generator Engines " (1s.). F.I.A.T. 1018, " Rubber Vulcanization Accelerators Produced " by I. G. Farbenindustrie, A. G. Hoechst, Elberfeld, Leverkusen " (8s.).

Battersea Collier Sunk

On Tuesday last week the London Power Company's collier *Charles Parsons* (1,554 tons), proceeding from South Wales with a cargo of coal for the Battersea power station was in collision with the 3,595-ton *Cydonia* two or three miles off Southend. She sank rapidly but the crew were picked up by a Norwegian steamer, the *Ulv Jahl.*

B.S. for Electric Travelling Cranes

A British Standard, No. 466, deals with electric overhead travelling cranes, power-driven in all motions, for general industrial (indoor or outdoor) use, but not with special heavy-duty cranes. Principles (but not details of design) that govern reliability and safety are laid down. In addition to the revisions made as a result of experience gained since the issue of the previous standard in 1932, new clauses have been added and appendices dealing with materials and ancillary equipment and with statutory requirements have been extended. Copies are obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1, at 4s. post free.

Non-Ferrous Metals Directorate

The Ministry of Supply announces that the address of the Non-Ferrous Directorate is now 2, Hyde Park Street, London, W.2. Telephone Ambassador 1290; telegraphic address remains " Metrol, Padd, London."

Dutch Million-Volt Generator for Britain

A 1,000,000-V generator for the transmutation of atoms, which is to be used by Oxford University for nuclear research, has been completed in the Philips laboratories at Eindhoven. Work has begun on a similar generator also for export.

" Argonarc " Welding

Four papers on this method of welding magnesium alloys (though stainless steel is also referred to) have been published as a special report (LM.3/28, price 7s. 6d.) by the British Welding Research Association, 29, Park Crescent, London, W.1. Three of the papers record early experiments with equipment which was initially designed for helium-shielded arc welding. The fourth paper describes the series of later investigations carried out during the last four years, details procedure and includes data as well as an explanation of the use of high-frequency current for stabilizing the arc. Types of welded joints which can now be made in this way are illustrated in an appendix.

The British Oxygen Co., Ltd., has been instrumental in developing this process in this country under the name of " Argonarc " because argon is the inert gas used for shielding the arc. The process has been widely developed in the United States by the Linde Air Products Co., under the name of " Heliac," because helium gas was first used, but argon is now commonly employed to surround the molten metal area with a gaseous shield, which excludes air, thus minimizing oxidation and burning of the metal. A smaller volume of argon suffices because its weight results in dispersion at a slower rate than helium, which is lighter than air. Non-inflammable argon is extracted from the atmosphere by fractional distillation, compressed and stored in steel cylinders, which are painted blue for identification.

Argentine Import Regulations

The *Board of Trade Journal* publishes a list of articles considered essential which have been authorized for importation into Argentina. Such goods imported from the United Kingdom are subject to the system of prior consideration.

Ceylon Restrictions

All import licences issued by the Ceylon Government before August 22nd have been cancelled for the following goods originating from countries outside the sterling area: Torch bulbs, electric lighting accessories and fittings, radio goods and apparatus, batteries and accumulators (except flashproof for motor vehicles), electrical goods and apparatus, refrigerators and refrigerating machinery. Licences will be revalidated to permit the shipment of such goods from the country of origin direct to Ceylon on or before October 31st.

British Council Scholarships

The British Council has awarded scholarships for 1947–48 to 256 graduates or others of like status from 62 countries, including the Dominions and Colonies, to enable them to undertake a year's specialist study in the United Kingdom. In addition, 106 British Council scholars have had their scholarships extended for a further year. Forty of the scholarships are for engineering.

A Vickers Exhibition

In 1931 a showroom was opened at Vickers House, Broadway, Westminster, London, S.W.1, to house a representative exhibition of the products of the companies comprising the group of Vickers, Ltd. This was closed down during the war, but it has now been renovated and restocked with a selection of models of the larger productions and actual examples of some of the smaller machines, including shipbuilding, aircraft construction and general engineering. Vickers-Armstrong are represented by models of cement-making plant, condensing plant,

colliery winders, mine skips and cages, coal handling plant, variable speed gears and pumps, and a torsional vibration damper. The products of the English Steel Corporation, Ltd., include specimens of drop stampings, alloy steels and engineers' small tools, and the company's "Staybrite" stainless steel is shown in various forms. The exhibits of Ioco, Ltd., include "Formapex" laminated plastics and electrical insulating materials.

In opening the showroom Sir Ronald Weeks (deputy chairman of Vickers, Ltd.), said that the transition from war to peace had been carried through with a degree of skill which had resulted in the creation of an organization capable of playing a vital part in Britain's industrial recovery.

Czech Cables for Russia

Czechoslovakia is to supply Russia with cables under the terms of an agreement negotiated in Moscow. The deliveries cover the whole of next year, and it is stated that shipments over a further four years were discussed. Russia will supply the necessary raw materials.

American Company's Scottish Works

Remington Rand is the latest American electrical company to take over a Scottish factory, part of the former Rolls-Royce works at Hillington, Glasgow, having been made available.

Lamp Publicity

Cryselco, Ltd., has produced a coloured cut-out of one of its lamps upon which the picture of a reader is imposed with the advice "Read in the Right Light."

Electrical Housecraft Advisers

The annual meeting of the Association of Electrical Housecraft Advisers was held on October 25th, when Miss M. G. Gosse (chairman) said that the main reason for forming the Association was to provide a negotiating body that would be truly representative of the experienced and trained women of the industry. It was a matter of great concern that numerically at the present time the Association could not claim this representation. A Wages Council was in process of being formed. This meant that whatever their qualifications, technical or professional, they would all be classed by this Council in the same category as a saleswoman in the electrical department of a large stores. Fortunately, the B.E.A. had lodged a protest. They should have been in the position of backing that protest, but with their present membership they would not have had a hope of being heard. They appreciated what E.D.A. had done to bring to the notice of the industry the importance of giving housecraft advisers salaries commensurate with their status. The objections which they voiced were the basing of the salaries on the kW load, and the fact that the leading women in the industry were not consulted before publication.

Hornsey Fuel Economy Campaign

Recently the Mayor of Hornsey, Alderman L. J. Valette, J.P., inaugurated a Fuel Economy Campaign at the Rink Cinema, Finsbury Park, where three exhibits were arranged by the Hornsey Electricity Department, the Hornsey Gas Co. and the Ministry of Fuel and Power. An address to an audience of about 2,300 was given by Sir Guy Nott-Bower, Deputy-Secretary, Ministry of Fuel and Power.

Trade with Austria

The Board of Trade announces that, following the termination of the state of war with Austria, Orders have been made under the Trading with the Enemy Act which allow the full resumption of trade between the United Kingdom and Austria, hitherto permitted to a limited extent only. Money and property in the United Kingdom at the date of the Orders belonging to persons resident or carrying on business in Austria and income derived therefrom, continue to remain under Board of Trade and Custodian of Enemy Property Control.

"Women in Industry" Exhibition

The theme of the G.E.C.'s stand at an exhibition held at the Gaumont Cinema, Coventry, as a climax to the Ministry of Labour's campaign to bring more women into industry, was "There's a place for you at the G.E.C." Four girls from the telephone works, Stoke, Coventry, demonstrated switchboard wiring, condenser wiring, drilling and press operating. A member of the company's employment department was present throughout to answer questions. In addition to this display, the G.E.C. showed samples of modern telecommunication equipment and a number of photographs of the recreational and welfare facilities offered to employees.

Tube Investments Scheme

Tube Investments, Ltd., is offering to the 25,000 men and women operatives employed in the works of subsidiary and associated companies a scheme of pensions and life assurance, to start from December 1st next. A similar scheme already exists for the staff. The scheme provides a life pension for men from sixty-five and for women from sixty, varying in amount according to their wage rates and years of service; and a substantial life assurance during the years of employment. The company will subscribe over half of the weekly payments for each pension, and is making a further payment, estimated at between £600,000 to £750,000, to secure benefits for past service by employees

without their subscribing for the years before the scheme started; and it will also bear the whole cost of the life assurance.

Trade Announcements

H. H. Linton & Co., Ltd., inform us that they are no longer acting as distributors for Erinex kettles and elements.

Laurence, Scott & Electromotors, Ltd., announce that their Newcastle office is moving on November 11th to Baltic Chambers, Quayside, Newcastle-on-Tyne, 1. The telephone number will remain unchanged.

L. Bunce (Electrical), Ltd., Dudley, inform us that Cosmos Exporters, Ltd., of 107-109, New Oxford Street, London, W.C.1, have been appointed their export and London agents.

The Britmac Electrical Co., Ltd., has opened a London office at 121, Victoria Street, London, S.W.1 (telephone: Victoria 9778). This office will be closed on Saturday mornings. It is not intended to carry any stocks in London.

In order that there should be no misunderstanding regarding the note appearing on page 630 of our last issue, **Crypto Ltd.,** North Circular Road, London, N.W.10, announce that Mr. F. Porter, former branch manager of their undertaking in Leicester has recently been transferred to their Leeds branch at 51, St. Paul's Street, Leeds, 1, under the control of Mr. W. H. Lowth. Mr. Porter has assumed the duties of kitchen trade technical representative in one of the Leeds territories. It is also pointed out that the Porter Electrical Products, Ltd., is in no way associated with Crypto, Ltd. The Leicester branch of Crypto, Ltd., is still at 14, Highcroft Street, under the management of Mr. F. L. Ingram.

Trade Publications

Oliver Pell Control, Ltd., Cambridge Row, Woolwich, London, S.E.18.—Priced leaflet on the "Varley" dry battery torch for industrial and general uses.

Murex, Ltd., Rainham, Essex.—Illustrated folder on "Eel" brand nickel hardened anti-friction metal for lining bearings, recently approved for use in machinery for ships of Lloyd's classification.

Yarrow & Co., Ltd., Scotstoun, Glasgow, W.4.—Illustrated brochure fully describing, with test results, the boiler installation at the Castle Meads power station of the Gloucester Corporation.

Coal Price Structure

Preparation and Utilization Costs

A SYSTEM of buying and selling coal to a specification drawn up on a stable technical-commercial basis was presented by DR. E. S. GRUMELL to the East Midland Section of the Institute of Fuel last Saturday. The title, "The Price Structure of Coal and its Relationship to Preparation and Utilization," indicates the wide scope of the paper, and the following extracts relate to its bearing on electricity generation.

The proposed method of evaluating coal was in three parts. The primary evaluation was concerned with the number of heat units in the coal and its effect on charges for transport and handling. The second, the efficiency factor, registered the effect of such elements as moisture, ash, ash-fusion temperature, caking power, size and uniformity. Finally, the utility or convenience factor took account of such matters as the greater value of sized coals in respect of output, draught requirements, labour and capital expenditure; ash handling and disposal; maintenance including that due to sulphur corrosion, slagging and grit emission; cost of pulverizing; value of specific qualities (e.g., high-volatile free-burning as against low-volatile caking), output and draught requirements; value of by-products in carbonizing industries; and value of phosphorus-free coals.

Calorific values of British coals of different "ranks" (or groups of natural characteristics) could vary by as much as 6,560 B.Th.U. per lb, and up to 4,940 B.Th.U. difference had occurred in the same district, both including ash and moisture. Power station coal generally contained 10 to 15 per cent of ash, which in addition to lowering calorific value interfered with the distribution of air in the fuel bed, resulting in lower CO_2 and greater carbon losses in clinker and grit emission. Each 1 per cent increase in ash content above 8 per cent decreased efficiency of combustion by 0·33 per cent, which provided the efficiency correction factor proposed.

The official price margin of 3s. 1½d. between untreated smalls and higher quality coals in December, 1944, would be 5s. 9½d. on a heat unit basis. Allowing for the proposed efficiency factor the total would become 8s. 9d. The cleaning of coal would probably prove justifiable having regard to the greater consequent efficiency in use, and this raised the question of whether coal should be sold at the pit or as delivered. The nature of the problem was shown by the high proportion (about 83 per cent) of industrial coals (2 in. and under) which was already cleaned and reasonably consistent in quality. Of the uncleaned coal, power stations took about 55 per cent.

Existing prices for various sizes and qualities of coal in a certain district, distorted by wartime flat-rate increases, were tabulated for comparison of the proposed method of charging with official prices as a basis for investigation by a competent authority. One appendix dealt with quality control of uniformity of coal supplies and another with the cost of cleaning coal.

Overseas Electrical Trade

September Exports Four Times 1938 Average

SEPTEMBER electrical exports only just failed to regain the record monthly level attained in July, the total for goods and machinery being £7,318,093 against the July figure of £7,333,719. The value was thus almost exactly four times the monthly average for 1938 and 88 per cent above the September, 1946, total.

It is apparent from Table I that cable shipments were largely responsible for this remarkable advance; as a class they aggregated £1,374,388 as compared with £781,380 in September last year and a 1938 monthly average of £359,881. The outstanding customer for non-submarine telegraph and telephone wires and cables was South Africa whose purchases amounted to £113,279, against only £17,041 in the corresponding month of last year. The Union was also a large buyer of other cables but was well below British India in this section; the share of India was no less than £236,177 in the case of rubber-insulated cables and £57,733 in other types.

There was a further advance in exports of radio equipment. In the case of domestic receivers (totalling £425,656 against an average of only £36,755 in 1938) South

Table I.—Electrical Exports and Imports

Class	Exports			Imports		
	Sept., 1947	Sept., 1946	Monthly Av., 1938	Sept., 1947	Sept., 1946	Monthly Av., 1938
	£	£	£	£	£	£
Telegraph and telephone wires and cables, submarine	76,361	80,053	17,289			
Ditto, not submarine	343,523	133,061	71,803			
Wires and cables, other than telephone and telegraph, rubber insulated	603,927	220,387	117,533	9,929	1,614	31,246
Ditto, insulation other than rubber	350,577	347,879	153,256			
Commercial radio apparatus	104,388	60,937	28,296	*	*	*
Domestic radio receivers	425,656	334,336	36,755	617	9,529	10,148
Telegraph,telephone and signalling apparatus	†704,582	417,474	242,716	3,642	1,874	9,243
Other radio, etc., apparatus	303,348	132,248	57,848	22,709	269,858	47,870
Valves	128,734	92,974	41,272	29,227	8,924	10,893
Electric carbons, furnace	*	*	*	83,975	1,010	4,054
Other electric carbons	*	*	*	6,114	2,532	2,301
Electric lamps	105,478	81,674	49,440	4,712	1,112	10,265
Other lighting apparatus	319,747	170,977	48,565	4,609	792	38,662
Primary batteries	56,204	51,343	13,572	874	62	3,549
Accumulators for motor vehicles	137,086	93,294	16,418	*	*	*
Ditto, other portable	55,441	25,989	12,456	*	*	*
Ditto, stationary	18,324	6,966	19,773	*	*	*
Ditto, parts and accessories	57,857	42,664	*	*	*	*
Electric cooking and heating apparatus	209,842	96,438	30,664	*	*	*
Commercial electrical instruments, including ammeters, voltmeters, etc., and parts	87,386	45,228	15,878			
House service meters	126,265	40,406	15,791	16,733	8,208	32,057
Other electrical instruments	83,269	24,503	9,612			
Electro-medical apparatus other than X-ray	17,963	13,178	3,038	*	*	*
X-ray apparatus, vacuum tubes and parts	52,092	33,595	4,881	25,527	6,069	9,734
Insulating materials, not elsewhere specified	107,042	75,163	19,343	*	*	*
Unclassified electrical goods and apparatus	348,671	265,986	108,083	25,463	8,723	52,980
Generators, complete up to 200 kW	138,462	64,085	38,071	*	*	*
Ditto, over 200 kW	522,113	194,534	119,079	*		
Ditto, parts	292,642	30,557	*	*		
Railway and tramway motors	50,751	39,988	15,977			
Other motors up to ½ h.p.	36,656	19,177	9,001			
Ditto, over ½ h.p. but under 1 h.p.	39,160	11,575	2,470	12,696	2,893	26,033
Ditto, 1–250 h.p.	240,275	163,696	96,637			
Ditto, over 250 h.p.	12,752	30,931	20,960			
Converting machinery	8,630	1,754	101,304	*	*	*
Transformers including coils	338,721	130,246				
Rectifiers for power house use	31,884	9,130	3,463	*	*	*
Motor starting and controlling gear	80,949	50,633	50,866	*	*	*
Switchgear and switchboards, other than telegraph or telephone	376,178	149,856	184,533	*	*	*
Other electrical machinery	27,672	11,981	15,497	71,901	5,200	14,455
Electric vacuum cleaners and parts	269,496	81,067	26,662	*	*	*
Other electrically-operated portable appliances	27,989	37,330	10,394	4,093	1,160	24,627
Total	7,318,093	3,883,313	1,829,198	322,641	329,560	328,117

* Not classified separately. † The figures for 1947 are not strictly comparable with those for previous years.

Africa was again in the lead with a share valued at £135,501 (£2,809 monthly average in 1938). Other outstanding importers were Egypt, British Malaya, Palestine and Iran. Among the buyers of telegraph and telephone apparatus South Africa was once more the leader—£166,629 of a total of £704,582. British India (£91,914) was the principal importer of lighting equipment. A further large increase occurred in exports of cooking and heating apparatus, from £96,438 in September, 1946, to £209,842. Another class which rose considerably was instruments, the total value of exports being £296,920 compared with £110,137 in September last year and £41,281 as the 1938 monthly average. Exports of vacuum cleaners at £269,496 were over three times the September, 1946, figure and over ten times the 1938 monthly average.

Table II.—Distribution of Exports of Electrical Goods and Apparatus

Destination	Sept., 1947	Sept., 1946	Monthly Av., 1938
	£	£	£
Eire	158,244	145,220	37,726
Channel Islands	40,504	35,200	12,177
Palestine	119,979	59,538	8,426
British West Africa	45,490	48,710	12,899
Union of South Africa	647,808	312,567	162,584
Southern Rhodesia	43,533	16,627	9,632
British East Africa	53,817	25,807	7,893
British India	816,723	315,684	123,789
Burma	98,307	36,012	5,337
British Malaya	165,403	62,327	32,792
Ceylon	56,778	28,186	15,048
Hong Kong	67,031	33,519	12,939
Australia	181,859	185,551	197,366
New Zealand	258,514	124,808	96,225
Canada	61,802	21,499	12,547
British West Indies	36,116	42,319	12,954
Other British Countries	79,065	87,227	21,265
Soviet Union	20,682	466	36,781
Finland	22,398	4,582	5,969
Sweden	159,974	56,793	14,948
Norway	186,775	82,555	12,881
Iceland	27,021	44,492	2,796
Denmark	54,608	110,461	18,907
Poland	11,639	8,622	9,702
Netherlands	85,981	88,703	22,010
Belgium	96,510	90,071	11,208
France	36,729	56,015	16,082
Switzerland	23,938	71,388	3,768
Portugal	50,978	46,667	6,512
Spain	27,862	65,260	3,813
Czechoslovakia	31,192	7,512	7,256
Yugoslavia	26,387	11,810	1,475
Greece	30,710	10,190	4,926
Turkey	99,766	77,184	7,684
Portuguese East Africa	6,317	6,550	6,942
Egypt	68,607	57,454	13,176
Iraq	73,908	36,817	5,530
Iran	86,939	60,171	16,345
China	55,895	23,192	4,119
United States of America	9,025	8,999	5,839
Mexico	6,090	6,794	1,466
Venezuela	25,104	19,769	2,936
Chile	3,814	10,495	6,635
Brazil	189,807	69,206	11,164
Argentine Republic	128,914	92,310	45,452
Other Foreign Countries	245,220	81,424	46,371
Total	4,823,763	2,886,753	1,134,284

From Table II which shows the distribution of electrical goods and apparatus (not machinery) as a whole it will be seen that the premier place was taken by British India (£816,723), South Africa coming second with £647,808 and New Zealand third with £258,514. In all three instances the advance from the September, 1946, figure was very substantial. Australia's purchases fell below the 1938 average but Canada increased her share. Brazil (£189,807) led the foreign buyers among whom the following were also prominent:—Norway (£186,775), Sweden (£159,974), Argentina (£128,914) and Turkey (£99,766).

Increased Machinery Exports

Every item in the machinery section was greater, with the sole exception of motors of over 250 h.p. The leading item—generators of over 200 kW—advanced from £194,534 in September, 1946, to £522,113 last month and exports of smaller generators were more than doubled in value. Of the total value of generator exports (£953,217, against £289,176 in September last year) British India accounted for £224,221, more than ten times the amount set down for September, 1946. Other noteworthy buyers were Russia (£167,252, against nil) and Canada (£69,084, against £2,215).

With the exception noted, increases were recorded for all sizes of motors and there were large advances in shipments of transformers and switchgear. So far as motors were concerned British India (£103,556) was the principal market, with South Africa (£28,727) a poor second. The leading importers of other classes of machinery and switchgear were South Africa (£114,074), British India (£106,196), Australia (£77,211), New Zealand (£43,840), Eire (£28,011) and Russia (£24,324).

Table I shows that imports of electrical goods and machinery had about the same value in September as in the corresponding month of last year and the 1938 monthly average (which means that they were considerably lower in actual value) solely because radio apparatus purchases were very much lower—about £26,000 against £271,000. This reduction was offset by increases in the case of all the other specified classes, particularly carbons, cables, X-ray apparatus, valves and machinery. Imports of the last-mentioned class rose from about £8,000 to £84,000.

E.D.A.—E.A.W. Conference

Lord Citrine's Assurances

ASSURANCES regarding the position under nationalization of those engaged in the electricity supply industry were given by LORD CITRINE, chairman of the British Electricity Authority, at the second post-war conference, organized in London by the British Electrical Development Association and the Electrical Association for Women, for housecraft advisers, senior demonstrators and saleswomen in the electrical industry. Lord Citrine emphasized that the function of the B.E.A. was co-ordination of the fourteen separate Area Boards which would, however, remain autonomous. They had very serious responsibilities to ensure that dislocation should be avoided on the vesting day. So far he had discerned a general desire to co-operate.

The B.E.A. was now engaged in building up its organization. There were many preliminary difficulties to be overcome and he did not think there would be any too much time to complete the task by the vesting date. He had the great benefit that most of the members of the Authority had wide experience in the electrical industry and he was proud to have Dame Caroline Haslett to present the point of view of women in the home. They were at present attempting to provide a line of guidance for the Area Boards which had yet to be appointed. It was no easy task to appoint these Boards, for the Minister of Fuel and Power had to consider various interests and not be accused of partisanship. When they were appointed they would have the advice of the Authority in the undertaking of their work, but they had no need to take it.

Future under Nationalization

With regard to the future of E.D.A., Lord Citrine said it was obvious that, being composed substantially of the same constituents as those absorbed in the nationalized industry, it could not continue in exactly the same way and that clearly a reconstitution would be necessary. He hoped that the change would be as smooth as possible and the B.E.A. wanted the Association to carry on for the next twelve months with the minimum of change, after which there would be more time to consider its future.

The E.A.W. ought not and could not be absorbed into the B.E.A. or Area Boards and must be free to express its independent opinions. He was quite sure that the Authority would start with the desire that the good and useful work of the E.A.W. would be carried on much as in the past. He thought he could say that both Associations would not find it necessary to curtail their work on account of lack of funds.

Employees in the industry could rely on the Authority to "do the right thing" and every effort would be made to avoid hardship. For the first time in the industry there was a legal obligation to institute agreements under which employees would work. The position of women engaged in the industry was likely to be more secure than it had been in the past. Welfare, training and education were matters expressly stated in the Act as obligations of the Area Boards. This should result in a higher standard in the industry as a whole. On November 14th

Lord Citrine speaking at the opening of the Conference. With him are Mr. V. W. Dale and Dame Caroline Haslett

he Authority was to have a meeting with representatives of all classes of people engaged in the industry.

They in the industry had the privilege of providing the most modern source of power available. Though atomic energy might be used to generate electricity, it was not likely to replace it and when the present difficulties facing the world had been overcome the use of electricity would go up by leaps and bounds. It was part of the demonstrators' job at present to prevent the waste of electricity.

DAME CAROLINE HASLETT, director of the E.A.W., speaking of the responsibilities of the trained women in the electrical industry, said they were on the threshold of a new era in electrical history. New opportunities would bring new responsibilities and demonstrators were an important link with the consumer. There was much muddled thinking with regard to fuel economy and she felt they could give more constructive advice for the use of electricity in off-peak hours and so reduce the "frustration" of the housewife.

On the subject of "Electricity and Coal Conservation," MR. V. W. DALE, general manager and secretary of E.D.A., said that there was a tendency in some quarters for

electricity to become the " villain of the piece." Electricity was, however, making a great contribution to the saving of coal. To produce the amount of electricity used to-day it would twenty years ago have required 53 per cent of the nation's coal instead of only 13 per cent. E.D.A. was engaged in exploring all opportunities for electricity economy in various industries. In the coal mining industry, by using public supplies of electricity instead of privately generated power 4·2 million tons of coal could be saved a year. Railways would use only one-third the amount of coal if electrified. In Lancashire alone 750,000 tons of coal could be saved annually in the cotton industry. In the woollen industry a saving of about a million tons might be made. One of the contributory factors in the increased output in American factories was the greater use of power, which was about 2½ times that of this country.

Fuel Comparisons

Comparisons between the thermal content of the various types of fuel were misleading unless related to the efficiency of the apparatus. A statement had been made that 100,000 B.Th.U. produced by coal cost 4d., by gas 1s. 1d., and by electricity 2s. 5d. In most coal-burning apparatus 90-95 per cent of the heat was wasted and the best equipment so far produced had a working efficiency of only 20 per cent. Similarly gas fires had an efficiency of only 20-25 per cent. Electric fires on the other hand could not have an efficiency of less than 100 per cent.

" Refrigeration and Quick Freezing " was the subject of a talk by Mr. L. R. Martin (Frigidaire, Ltd.), illustrated by a colour film on the use of home freezers in the United States. Other subjects covered included " The Appreciation of Speech and the Value of Words," by Miss Amy Ryan; " Building Materials," by Miss Alma Dicker (London Building Centre); " Domestic Subjects Training Colleges," by Miss G. S. Haigh (principal, Domestic Science College, Leicester); " Training and Qualifications for the Electrical Industry," by Miss Vera Norvick (E.A.W.); " Fluorescent Lighting," by Mr. A. D. S. Atkinson (Lighting Service Bureau); and " Domestic Lighting and its Presentation," by Miss Margaret D. Wardlaw and Mr. T. O. Freeth (Lighting Service Bureau).

Lord Citrine was the principal guest at the Conference luncheon held on the final day at the Connaught Rooms. Mr. V. W. Dale, in introducing him, spoke of the privilege of having him at the Conference twice in three days. Lord Citrine in his opening address had, he thought, provided the answer to whether there would be a conference in 1948, and it was almost certain that there would be one. He thanked Miss V. Norvick and Mr. Stedman, the two principal organizers of the Conference.

Lord Citrine spoke of the importance of speech making and education. He referred to the appointment of a chief education and training officer to the Authority and said that it was intended to develop a system of training from top to bottom of the organization. They, the demonstrators, were the people who came into contact with the housewife and heard her complaints, and theirs would be the job of making known to her what the industry could do.

University Engineering Research

Work of Queen Mary College Students

ELECTRICAL research as part of the university education of engineering students was the subject of the inaugural address of PROF. W. J. JOHN (Queen Mary College, East London) as chairman of the I.E.E. Transmission Section.

The Engineering School at his college possesses an adequately equipped high-voltage laboratory and a new impulse generator is now being installed. It is of the " controlled " type with nine stages, its capacitance being 0·085 μF per stage at 1·5 million volt output; with the addition of more stages a two million volt output is envisaged.

Prof. John explained that most of their research work had been done with impulse voltages and he proceeded briefly to summarize the investigations involved in three of the five Ph.D. theses which had been prepared by students during the past session.

The first was concerned with the characteristics and practical application of Lichtenberg figures, or klydonograms, the diameter of which had been proved experimentally to be a fairly accurate measure of crest voltage. It was claimed that the klydonograph was superior to the cathode-ray oscillograph for determinations in the field and the theses described a suitable design of instrument for producing positive and negative figures, both being desirable when recording lightning phenomena.

It was further suggested that the klydonograph could be of great assistance in determining the breakdown voltage of insulating materials and of transformer inter-turns under impulse tests. Finally a visual surge indicator developed in the course of work for this thesis was described.

Prof. John next referred to the second thesis study of superimposed oscillations in impulse generators built on the Marx principle, which prevent the output being of smooth wave form. Fresh analysis has yielded, without a prohibitive amount of labour, complicated mathematical expressions that enable discharge voltage/time graphs to be calculated.

The work so far completed for the third thesis had resulted in the formulation of a theory which explains dipole orientation in pure dielectrics, based on a visco-elastic model concept. Preliminary experiments had demonstrated the possibility of studying restricted dipole orientation in the solid state by using concentrated solid solutions of polar substances in paraffin wax.

ELECTRICITY SUPPLY

North Wilford Accident. Lighting Experiment Banned.

Aylesbury.—NO INCREASE IN CHARGES.—Although there was a loss of £4,963 on the past year's working of the electricity undertaking, charges are not to be increased. Making this announcement Councillor W. A. Narbeth, chairman of the Electricity Committee, said they had a reserve of £60,000 and considered that the consumers were entitled to have the benefit of it. Councillor S. H. Smith suggested that the Committee might give some discount to people who had contributed to that reserve.

Clitheroe.—LOCAL TREES FOR OVERHEAD-LINE POLES.—The borough electrical engineer has given satisfactory reports of locally grown trees converted into overhead-line poles, 160 of which will be available for his Department.

Fulham.—20 PER CENT DISCOUNT CONTINUED.—Having considered the results of the year's working the Electricity and Lighting Committee recommends the continuation of the 20 per cent discount on all accounts, except under special agreements, until further notice. The year's income amounted to £356,704 and there was a surplus of £13,947 (against £62,419 in 1945-46). Sales aggregated 64·3 million kWh at an average price of 1·092d., compared with 61·3 million at 1·117d. in the preceding year.

METER CONCESSION.—At present one lighting meter is allowed rent free, but 2s. 6d. per phase per quarter is payable on the first heating meter unless the quarter's consumption is 60 kWh or more. In view of the economy campaign it is proposed that no rent shall be charged for this meter; 2s. 6d. per quarter will, however, be payable for any additional meter.

Leicester. — TRANSFORMER FIRE. — When a 2,000-V transformer at Victoria Park caught fire on October 22nd a large part of the London Road district of the city was without electricity for about three hours. A temporary transformer was installed to enable the supply to be resumed.

Liverpool.—CLARENCE DOCK EXTENSIONS.—The city electrical engineer has been authorized to engage Mouchel & Partners, Ltd., as consulting engineers for the civil and engineering structural works in connection with the 1951 extensions to the Clarence Dock generating station.

Macclesfield.—PROPOSED DIESEL PLANT.—The Electricity Committee has submitted a scheme to the Electricity Commissioners for the installation at the George Street works of fourteen 16,000-h.p. high-speed Diesel engines complete with 11-kV a.c. generators, at an estimated cost of £365,000. This installation will give a total generating capacity at the works of 15,000-kW, with a continuous rating of 11,000 kW.

Mansfield. — LOANS SANCTIONED. — Consent has been received to the borrowing of £4,011 for the provision of a supply of electricity to a factory in Sutton Road. Sanction has also been obtained to borrow £7,150 for a proposed substation at Nag's Head, Pleasley, and for extensions of the 11-kV system to Forest Town.

Morley.—DISCOUNT MOVE DEFEATED.—"I am not in favour of milking the cow before we hand it over," said Alderman Ward, chairman of the Finance Committee, in opposing a recommendation of the Electricity Committee that part of the undertaking's £4,902 surplus should be returned to consumers in the form of a 15 per cent discount for the six months ended September 30th. The recommendation was rejected by the Town Council.

Nottingham.—POWER STATION BREAKDOWN.—A 90-minute interruption of electricity supplies took place on October 21st as the result of an accident at the North Wilford power station. Mr. M. Wadeson, the city electrical engineer, in an official statement, said that contractors' men working over the busbar room on the new extension allowed water to run through on to the 33-kV busbars.

Otley.—MINISTRY VETOES LIGHTING SCHEME.—The proposal of Electrical Distribution of Yorkshire, Ltd., to install an experimental length of fluorescent lighting in Kirkgate, Otley, has been banned by the Ministry of Transport. Otley was asked to permit the installation of lighting by tubes fixed to walls and buildings. In refusing sanction the Ministry said that in normal circumstances the experiment would provide interesting information, but the application had to be considered in view of restrictions on street lighting. It was, however, prepared to give further consideration to an amended proposal on "less extravagant lines."

Stockton-on-Tees. — LOANS SANCTIONED. — The Town Council has received sanction to borrow £7,410 for the supply of electricity to the North Tees trading estate, including £3,331 for mains and £4,079 for substation equipment. Sanction has also been received to the borrowing of £5,900 for supplying electricity to the Oxbridge Lane area and £2,512 for supplying electricity to the Bowesfield industrial site.

Torquay.—H.V. CABLE.—The Corporation is considering a scheme for laying an 11-kV underground cable between the Upton Valley and Nutbush substations, a distance of approximately two miles. The estimated cost is £12,776.

West Midlands.—EXTENSIONS AT OCKER HILL.—The first of the two 30,000-kW sets which are being installed at the Ocker Hill generating station is expected to be put into commission in December and the second in February.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Isle of Thanet Electric Supply Co., Ltd., reports a profit for 1946 of £67,453, as compared with £51,069 for the preceding year, plus interest of £554. After deducting sinking fund, debenture interest, etc., and adding £6,863 brought in, there is a balance of £51,598. The preference dividend for the four years to March 31st, 1944, absorbs £37,224, and the balance carried forward is £14,374. The dividend on the preference shares for the year ended March 31st, 1945, was paid on September 10th, reducing the undistributed profit to £5,068. The report states that agreement of the final purchase price of the electricity undertaking has been delayed pending the settlement of the company's liability for local rates. This matter has been settled and the directors hope to call an extraordinary general meeting before the end of the year to pass a resolution that the company be wound up voluntarily by members.

Bagdad Light & Power Co., Ltd.—At the annual meeting last week Sir Kinahan Cornwallis (chairman) reported that 20,852,000 kWh was sold in 1946, an increase of 283,000 kWh. The number of consumers rose from 23,107 to 25,831. The erection of a 6,000-kW set had been completed and would allow some alleviation of the restrictions, but the position would not be fully satisfactory until an additional 12,500-kW set on order was available.

An extraordinary general meeting was held subsequently when stockholders approved proposals to issue a further 150,095 7 per cent cumulative preference shares of £1 at 22s. each and 99,905 ordinary shares of £1 at 30s., to be converted, when fully paid, into stock units.

Burco, Ltd., proposes to pay a first and final dividend of 35 per cent (against 20 per cent dividend and 15 per cent bonus last year). The net profit was £50,430 (£41,521).

The British Electric Traction Co., Ltd., is paying an interim dividend of 15 per cent (same) on the deferred ordinary stock.

The Pressed Steel Co., Ltd., is maintaining its interim dividend at 10 per cent.

The Ever Ready Co. (Gt. Britain), Ltd., is maintaining its interim dividend at 15 per cent.

The Revo Electric Co., Ltd., is paying an unchanged interim dividend of 5 per cent.

New Companies

Taylor & Ward (Huddersfield), Ltd.—Registered October 14th. Capital, £2,500. Electricians, radio engineers, electrical engineers, experts and contractors, metal and alloy makers, wire makers, etc. Directors: T. O. Taylor, A. Wood and G. D. Hardy. Regd. office: 72, Buxton Road, Huddersfield.

Unilectric Engineering Co. (Hallamshire), Ltd.—Registered October 15th. Capital, £500. Directors: A. Seddon, H. Freeman and A. King. Regd. office: 50, Gleadless Drive, Sheffield, 2.

Philpot Brothers (Electrical Engineers), Ltd.—Registered October 15th. Capital, £9,000. To acquire the business of electrical engineers carried on by F. H. Philpot and J. F. Philpot as Philpot Brothers at 35, Upper Tooting Road, S.W.17. Directors: F. H. Philpot and J. F. Philpot. Regd. office: 35, Upper Tooting Road, S.W.17.

Radyne, Ltd.—Registered October 1st. Capital, £100. Designers, manufacturers, repairers and consultants and dealers in industrial or domestic heating, sterilizing, testing and control equipment and appliances, manufacturers of radar, picture or television transmitters and receivers, etc. Directors: D. F. Wheeldon and J. F. Cullingham. Regd. office: 42, Bedford Avenue, W.C.1.

Liquidations

G. A. Ryland's Electrical & Engineering Co., Ltd.—Meeting of members at the offices of the Midland Iron & Hardware Co. (Cradley Heath), Ltd., Forge Lane, Cradley Heath, on November 24th to receive the final account of the liquidator, Mr. R. Griffiths, of the winding-up of the company.

Worcester Radio Relay Service, Ltd.—Meeting November 28th at 395, High Street, Chatham, Kent, to receive an account of the winding-up by the liquidator, Mr. L. V. Scambler.

Bankruptcies

C. H. Boot, radio and electrical engineer, formerly residing and carrying on business at 29, Lyndon Road, Rubery, near Bromsgrove, Worcs.—First and final dividend of 1s. 10d. in the £, payable November 17th at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham, 2.

C. Peacock, electrical engineer, carrying on business at 51, Gillygate, York.—Adjudication order dated October 23rd, 1924, annulled on September 23rd, 1947, it appearing to the satisfaction of the Court that all the debts have been paid in full.

J. S. Plumbe, residing at and lately carrying on business in co-partnership with another at Liverpool Road, South Maghull, Lancs, and also lately carrying on business at Guildhall Road, Aintree, Liverpool, as Plumbe & Bowyer, electrical contractors.—Application for discharge to be heard on November 27th at the Court House, Fruit Exchange Buildings, Victoria Street, Liverpool.

STOCKS AND SHARES

STOCK Exchange markets are subject at the moment to cross-currents. One is the support rendered to British Government securities by Mr. Dalton's expressed determination to maintain the national credit on a 2½ per cent basis. The other element, operating in the opposite direction, is the coming of an autumn Budget that is expected to make its appearance within the first week or ten days of November. Sir Stafford Cripps, in his statement to Parliament last week, painted a sombre picture of the economic prospect, but his statement failed to check the rising prices of gilt-edged securities, although it led to a slight weakening of values amongst industrial ordinary shares. Stock Exchange business is running on very quiet lines. The general atmosphere is one of suspense and uncertainty, which will naturally continue until the forthcoming Budget is out of the way.

Home Electricity

Prices of Home electricity shares continue very firm. As compared with a month ago, the changes are insignificant. Little stock comes to market: holders are content to await the transfer of their present interests. The prices of British Government securities mount higher and higher without this having any effect upon the ordinary shares of the electricity supply companies, but the debenture stocks and preference shares have strengthened, and in a number of cases are difficult to buy.

Newcomers

Dealings were due to start this week in the newly introduced ordinary shares of Associated Insulation Products. Particulars published as a preliminary to the introduction describe the business as that of a holding, finance and management company, with chief interests in the mica, electrical and plastics industries. Among the subsidiaries is the Micanite & Insulators Co., the electrical insulation engineers. Earnings for the first part of this year are reported to be well above the corresponding figures for 1946, when the total, after adjusting taxation to present levels, was equal to just over £90,000 net. There appears likely to be, therefore, a comfortable margin of earnings for the 16 per cent dividend which the directors have in mind for 1947. At the placing price of about 14s., the yield on that distribution would be nearly 5¾ per cent. Total issued capital is £456,000. Out of this, 375,000 5s. shares are being marketed.

Murex and Reyrolle

Murex 4 per cent preference shares, offered recently to the company's stockholders, are now in the market at a premium of 2s. on the issue price of 20s. They can be bought in the form of renounced allotment letters, free of transfer stamp—a material consideration now that this 2 per cent duty adds 50s. to the cost of 100 shares at the price in question. Dealings in the new Reyrolle 4 per cent preference, issued at 20s. 6d., were due to open this week.

Plastics

Plastics shares form one of the most volatile sections of the industrial market. In view of the connection of the trade, through insulating materials and mouldings, with the electrical industries, attention may be drawn to the manner in which the more popular shares have fared during the market slump. Most of them have been handled fairly severely. For this, the responsibility probably rests to a large extent on the big speculative following which has been attracted to the shares by the exceptional possibilities considered to lie in the industry's future. Nevertheless, the share prices remain at levels which indicate lively confidence in better profits and dividends to come. British Industrial Plastics 2s. shares, for instance, despite a fall this year from 11s. 9d. to 7s., still yield less than 3½ per cent on last year's 12 per cent dividend. British Xylonite have come down from £15 to below £8, but yield under 3 per cent on the last conservative payment of 20 per cent. Lacrinoid have been up to 15s. 6d. this year and are now 6s., yielding 3⅓ per cent.

Thomas de la Rue

Thomas de la Rue is one of the several big undertakings which have developed important plastics interests as an adjunct to other established branches of business. Early this year a new company, National Plastics, was formed to take over the subsidiary De La Rue Plastics (now called British Moulded Plastics). In addition to the sale of this subsidiary, Thomas de la Rue has raised substantial amounts of fresh capital, this year, by the issue of preference and ordinary shares. Part of the new money was for use in the extension of the De la Rue Insulation Co. The 5s. shares are quoted at 43s. 9d., showing a yield of nearly 5¾ per cent on the current 50 per cent dividend. The price was up to 77s. 6d. earlier this year and has lately been as low as 36s. 3d.

A Month's Price Changes

Since a month ago, the radio group has been unsettled by the lower distribution and profits declared by E.M.I. The latter's shares show a net loss of 2s., at 19s., after being 17s. at one time. Deccas have fallen 3s. 9d. to 31s. 3d., Cossor 2s. 6d. to 20s. E. K. Cole, however, have recovered 1s. to 18s. 6d. Advances of 7s. 6d. in Murex to 87s. 6d., as a result of the dividend and profits statement, and of 10s. in Hopkinsons to 5½, following the increase in the interim distribution, are among the month's best features in the industrial markets. Burco finished the month with a net gain of 3s. 9d.; the dividend is repeated at 35 per cent for the

(*Continued on page* 675)

ELECTRICAL INVESTMENTS

Past Month's Price Changes

Company	Est. Comp.*	Last Div.	Middle Month's Price Oct. 24	Rise or Fall	Yield p.c.
Home Electricity Ordinary					£ s. d.
Bournemouth and Poole	66/8	12½	61/–	..	4 2 0
British Power and Light	37/10	8	34/6	..	4 14 2
City of London	34/4	7	31/3	..	4 9 7
Clyde Valley	46/5	8	42/6	..	3 15 3
County of London	49/5	10	45/6	+6d.	4 8 0
Edmundsons	31/6	6	29/–	..	4 2 9
Elec.Dis.Yorkshire	51/–	9	46/6	..	3 17 4
Elec. Fin. and Securities	67/–	15	61/–	..	4 18 4
Elec. Supply Corporation	50/8	10	46/–	..	4 7 0
Lancs. Light and Power	37/7	7½	34/6	..	4 7 0
Llanelly Elec.	29/1	6	26/6	..	4 10 7
Lond.Assoc.Electric	29/6	6	27/–	..	4 9 0
London Electric	31/4	6	29/–	..	4 2 9
Metropolitan E.S.	48/–	9	44/–	..	4 1 10
Midland Counties	51/5	8	47/6	..	3 7 6
Mid. Elec. Power	47/–	9	42/6	..	4 5 0
Newcastle Elec.	32/7	7	30/–	..	4 13 4
North Eastern Elec.	36/6	7	33/6	..	4 3 4
Northampton	50/11	10	46/6	..	4 6 0
Northmet Power.	48/2	9	43/6	..	4 3 7
Scottish Power	46/1	9	42/–	..	4 5 9
Southern Areas	24/–	5½	23/6	+6d.	4 13 7
South London	33/–	7	30/–	..	4 10 4
Yorkshire Elec.	50/10	9	46/6	..	3 17 4

Company	Dividend Previous	Dividend Last	Middle Month's Price Oct. 24	Rise or Fall	Yield p.c.
Public Boards					
Central Electricity:					
1963–93	3½	3½	102	+½	3 8 8
1974–94	3½	3½	101	+½	3 3 9
London Elec. Trans.	2½	2½	95½	+1	2 12 8
Lond. Pass. Trans. Bd.					
A	4½	4½	122½	+2	3 13 6
B	5	5	117½	+1	4 5 1
C	3	3	61½	+2	4 17 7
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	15/–	+3/3	—
Calcutta Elec.	6†	6†	52/6	+12/6	2 5 9
Cawnpore Elec.	13	13	50/–	..	4 5 4
East African Power	7	7	45/6	–1/–	3 1 8
Jerusalem Elec.	5	6	26/–	+6d.	4 12 4
Madras Elec.	6	8	44/6	+2/–	3 12 0
Nigerian Elec.	12½	10	40/–	..	5 0 0
Palestine Elec. "A"	6†	7†	32/9	–4/3	4 2 10
Perak Hydro-elec.	6	7	13/–	+1/–	—
Tokyo Elec. 6%	—	—	53½	–7	—
Victoria Falls Power	15	19	6	+½	3 3 4
Whitehall Inv. Pref.	—	6	24/–	–2/–	5 0 0
Equipment and Manufacturing					
Aron Elec. Ord.	10	15	47/6	–½	6 4 0
Assoc. Brit. Eng.	8	12	42/6	..	5 13 0

Company	Dividend Previous	Dividend Last	Middle Month's Price Oct. 24	Rise or Fall	Yield p.c.
Equipment and Manufacturing (*Continued*)					£ s. d.
Assoc. Elec.:					
Ord.	10	15	75/–	–½	4 0 0
Pref.	8	8	43/6	+4/–	3 13 6
Automatic Tel.&El.	12½	12½	58/3	..	4 6 2
Babcock & Wilcox	12½	15	69/6	..	4 6 2
Baldwin, H.J.(2/–)	10	20	10/–	+1/3	4 0 0
British Aluminium	8	10	45/3	+1/6	4 10 4
B.I. Callender's	—	6½	36/6	–1/6	3 13 6
British Rola (2/–)	15	15	3/9	..	8 0 0
British Thermostat (5/–)	18½	23½	25/–	+⅛	4 14 0
British Vac. Cleaner (5/–)	30	20	13/9	–1/3	7 5 6
Brush Ord.(5/–)	10	4	6/3	–3d.	3 4 0
Burco (5/–)	20	35	27/–	+⅛	6 9 8
Chloride El. Storage	20	20	97/6	+5/–	4 2 0
Christy Bros.	17½	17½	75/–	..	4 13 4
Cole, E. K. (5/–)	20	20	18/6	+1/–	5 8 1
Cossor, A. C. (5/–)	12½††	25†	20/–	–2/6	6 5 0
Crabtree (10/–)	17½	17½	38/9	..	4 10 2
Crompton Parkinson Ord. (5/–)	22½	22½	26/–	–2/6	4 6 7
De La Rue (5/–)	45	50	43/9	–⅛	5 14 3
Decca (1/–)	100	112½	31/3	–3/9	3 12 0
E.M.I. (10/–)	8	6	19/–	–2/–	3 3 2
Elec. Construction	12½	12½	47/6	+2/6	5 5 1
Enfield Cable Ord.	12½	7½	40/–	–⅛	3 15 0
English Electric	10	10	52/9	–2/–	3 15 0
Ericsson Tel. (5/–)	20†	20†	40/–	+⅛	2 10 0
Ever Ready (5/–)	40	40	33/6	–1/–	5 19 4
Falk Stadelmann	7½	10	41/3	..	4 17 1
Ferranti Pref.	7	7	33/9	+1/3	4 3 0
G.E.C. Pref.	6½	6½	35/9	+2/–	3 12 10
Ord.	17½	17½	85/–	–1/3	4 2 5
General Cable(5/–)	15	25	37/6	+2/6	—
Greenwood & Batley	15	15	45/–	–½	6 13 4
H.T.A. (10/–)	10	10	13/9	–2/9	7 5 6
Heatrae (2/–)	12½	12½	5/–	–⅛	5 0 0
Henley's (5/–)	20	20	23/6	+1/–	4 5 1
4½% Pref.	4½	4½	25/–	+1/–	3 12 0
Hopkinsons	20	22½	5½	+10/–	4 8 0
Intl. Combustion (5/–)	32½	37½	50/–	–½	3 15 0
Johnson & Phillips	15	15	70/–	+⅛	4 5 9
Lancashire Dynamo	22½	22½	47½	..	4 12 3
Laurence, Scott(5/–)	12½	12½	11/–	+1/–	5 13 8
London Elec. Wire	7½	10	42/6	..	4 14 1
Mather & Platt	10	11	49/6	–2/–	4 9 0
Metal Industries(B)	9	10	45/–	–⅛	4 9 0
Mid. Elec. Mfg.	30	35	8½	–½	4 3 9
Murex	20	20	87/6	+7/6	4 11 9
Newman Ind.(2/–)	22½	22½	6/9	+3d.	6 13 7
Plessey (5/–)	20	30	22/–	..	—
Parsons C. A.	—	12½	67/6	–2/6	3 14 0
Pye Deferred (5/–)	25	25	21/3	–⅛	5 17 8
Radio & Tel. (2/–)	25	40	5/9	+3d.	—
Revo (10/–)	20	27½	50/9	+9d.	5 8 6
Reyrolle	12½	12½	66/3	–⅛	3 17 2
Scophony (5/–)	—	—	5/–	–⅛	—

(*Continued on page 675*)

* Proposed amount of British Electricity Stock to be allotted.
† Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Oct. 24	Month's Rise or Fall	Yield £ s. d.
Equipment and Manufacturing (*Continued*)					
Siemens Ord. ..	7½	7½	32/6	+1/6	4 12 4
Strand Elec. (5/-)	12½	17½	10/3	−1/-	8 10 8
Switchgear&Cowans (5/-) ..	25	10	17/-	+1/6	2 18 10
T.C.C. (10/-) ..	12½	15	30/-	..	5 0 0
T.C. & M. ..	10	10	47/6	+1/-	4 4 3
Telephone Mfg.(5/-)	9	9	9/-	..	5 0 0
Thorn Elec. (5/-)	20	25	21/3	..	5 17 8
Tube Investments	22½	22½	5½	−½	3 16 6
Vactric (5/-) ..	Nil	Nil	15/-	+1/16	—
Veritys (5/-) ..	7½	2½	4/6	−6d.	2 15 6
WalsallConduits(4/-)	55	70	51/3	..	5 9 4
Ward & Goldstone (5/-)	35	50	66/-	..	—
Watford (2/-) ..	15	15	6/-	−3d.	5 0 0
WestinghouseBrake	14	14	62/6	..	4 9 5
West, Allen (5/-)	7½	10	10/-	−3d.	5 0 0
Traction and Transport					
Brit.Elec.Traction:					
Def. Ord. ..	45	50	1325	+180	3 15 6
Pref. Ord. ..	8	8	185	+15	4 6 6
Calcutta Trams..	6½	7½	40/-	+7/6	3 15 0
Cape Elec. Trams	5	6	32/6	..	3 13 10
Traction and Transport (*Continued*)					
Southern Rly.:					
5% Prefd. ..	5	5	70½	+1	7 1 10
5% Pref. ..	5	5	113½	+2	4 8 1
T. Tilling ..	10	10	64/-	+1/-	3 2 7
West Riding ..	10	12	53/9	+1/3	4 9 5
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	132½	+11	4 10 7
Def.	1½	1½	30½	+3	4 18 4
Anglo-Portuguese	8	8	30/-	+6d.	5 6 8
Cable & Wireless:					
5½ Pref. ..	5½	5½	122½	+8½	4 9 9
Ord.	4	4	175	+22½	2 5 9
CanadianMarconi$1	Nil	4 cts.	10/-	−1/6	—
Globe Tel. & Tel.:					
Ord.	8½†	5†	44/-	+6/-	2 5 6
Pref.	6	6	33/0	+½	3 12 7
GreatNorthernTel. (£10)	18	15	31½	+1½	4 15 3
Inter. Tel. & Tel.	Nil	Nil	17½	+4½	—
Marconi-Marine..	7½	7½	28/-	−9d.	5 7 4
Oriental Tel. Ord.	4	4	50/6	+3/-	—
Telephone Props.	6	6	20/6	..	5 17 0
Tele. Rentals (5/-)	10	10	11/6	..	4 7 0

† Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from p.* 673)

year. British Thermostat hardened to 25s. There are losses of 5s. in Greenwood & Batley, 45s., of 2s. 9d. in H.T.A., 13s. 9d., and of 1s. 3d. in Heatrae at 5s. C. A. Parsons at 67s. 6d. and International Combustions at 50s. have eased 2s. 6d. apiece. Elsewhere, as a result of the proposed Eastern Telegraph 100 per cent tax-free dividend, Cable & Wireless ordinary have put on 22½ points to 175, and the preference 8½ to 122½. Anglo-American Telegraph preferred is 11 points higher at 132½. Atlas Electrics jumped 3s. 3d. to 15s. on the Montevideo developments.

Equipment and Manufacturing

As the accompanying investment list shows, electrical equipment shares have given a mixed performance over the past month, with little evidence of a decided tendency one way or the other. Several of the leaders have lost ground to a moderate extent. A.E.I. at 75s., English Electrics at 53s. 9d. and G.E.C. at 85s. show losses ranging from a florin to half-a-crown. Crompton Parkinsons at 26s. and Arons at 47s. 6d. lost 2s. 6d. apiece. On the other hand, the cable manufacturing group is mainly better, with improvements of 3s. 9d. in Johnson & Phillips at 70s., of 2s. 6d. in General Cables at 37s. 6d., and of smaller amounts in Henleys, 23s. 6d., and Siemens, 32s. 6d. Chloride Electrical are noticeably good at 97s. 6d., a gain of 5s. Ericssons have hardened to 40s., and Electric Constructions to 47s. 6d. The strength of preference shares is exemplified by gains of 4s. in A.E.I. " eights " at 43s. 6d., and of 1s., or more in G.E.C. 6½ per cents at 35s. 9d. and Henleys 4½ per cents at 25s.

Markets and the Budget

Apart from speculative support for gilt-edged stocks, the impression grows that safety-first investments are absorbing a good deal of money diverted from industrials by doubts about November's anti-inflation Budget. Among the measures popularly fancied for inclusion, higher income tax ranks as an outside chance, and the odds quoted against reduced food subsidies are lengthening. Increased purchase taxes, on the other hand, are generally regarded as probables; but the measure regarded as coming nearest to a certainty is a rise in company taxation. Revival of E.P.T. is held by most people to be an unduly morbid forecast; but many are framing policies on the assumption of perhaps a doubling of the distributed profits tax to 25 per cent. For these investors, conservative dividends have of course a marked attraction; and they do not like to see too much preference behind a company's ordinary capital, since the equity holder pays, in effect, for the tax on both.

Import Control in Burma

THE Government of Burma has revised its import control policy with a view to ensuring a favourable trade balance and stabilizing its currency. A new Open General Licence applicable to the United Kingdom and other British Empire countries except Canada and Newfoundland covers only a very restricted list of items.

Next Week's Events

Monday, November 3rd

NEWCASTLE-ON-TYNE. — King's College, 6.15 p.m. I.E.E. North-Eastern Radio and Measurements Group. "The Application of Electrical Technique to the Service of some other Industries," by H. Cobden Turner and G. M. Tomlin.

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre. "Electric Traction on the Southern Railway," by C. M. Cock.

LIVERPOOL. — Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Elements of Position Control," by Prof. K. A. Hayes.

Tuesday, November 4th

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. "The Teaching of the Principles of Electrical Machine Design," by L. H. A. Carr.

MANCHESTER.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre. "Neutral Earthing of Three-phase Systems, with particular reference to Large Power Stations," by J. R. Mortlock and C. M. Dobson.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. (London Students' Section). Problems Night.

LONDON.—The Oddfellows' Hall, 186, Hammersmith Road, S.W., 7 p.m. Association of Supervising Electrical Engineers (West London Branch). "The Industrial Use of High-Frequency Heating," by M. O. C. Horgan.

Wednesday, November 5th

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. (Radio Section). "Tests for the Selection of Components for Broadcast Receivers," by Dr. G. D. Reynolds.

LONDON.—I.E.E. (London Students' Section). Visit to the British Thomson-Houston Co., Ltd., Willesden.

LONDON.—At the Institution of Mechanical Engineers, Storey's Gate, S.W.1, 2.30 p.m. Institute of Fuel. "The Coal Resources of the Country," by D. Hicks.

LONDON.—At the Institution of Civil Engineers, Great George Street, S.W.1, 6 p.m. Institution of Heating and Ventilating Engineers. Discussion on paper on "District Heating," by D. V. H. Smith.

LONDON.—Science Museum, South Kensington, 7 p.m. Society of Instrument Technology. Joint meeting with the Society of Glass Technology. Discussion on "The Instrumentation of Glass Tank Furnaces," opened by H. L. Crooks and C. H. Stone.

MIDDLESBROUGH.—Cleveland Technical Institute, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. Report on "The Practical Training of Professional Electrical Engineers."

SOUTHAMPTON.—University College, 6.30 p.m. I.E.E. Southern Centre. "The High-Pressure Mercury-Vapour Discharge and its Applications," by V. J. Francis and W. R. Stevens.

LEICESTER.—College of Technology, The Newarke, 6.30 p.m. Institution of Heating and Ventilating Engineers (East Midlands Branch). "Heating by Convector Units," by H. T. Scott.

MANCHESTER. — Engineers' Club, Albert Square, 6.30 p.m. Manchester Metallurgical Society. "Electrical Strain Gauges," by E. Jones.

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 7 p.m. Junior Institution of Engineers (Midland Section). Chairman's address by L. Hunt.

Thursday, November 6th

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "Electric Traction on the Southern Railway," by C. M. Cock.

LONDON.—Wandsworth Technical Institute, 6.30 p.m. Institute of Welding (South London Branch). "Argon Arc Welding," by R. R. Sillifant.

LUTON.—Assembly Room, Town Hall, 7.30 p.m. Luton Electrical Society. Address on "Electricity and the Power Crisis," by C. T. Melling.

Friday, November 7th

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. (Measurements Section). Discussion on "Telephone Cable Measurements," opened by S. Hanford.

BIRMINGHAM.—At Joseph Lucas, Ltd., Farm Street, 6 p.m. Illuminating Engineering Society (Birmingham Centre). "High Voltage Fluorescent Light Sources," by H. G. Jenkins and J. N. Bowtell. Joint meeting with I.E.E. and E.C.A.

BIRMINGHAM.—Botanical Gardens, Edgbaston, 8 p.m. I.E.E. (South Midlands Students' Section). Annual dance.

BATH.—I.E.E. (Bristol Students' Section). "Digital Computing," by T. A. H. Marshall.

NEWCASTLE-ON-TYNE. — Old Assembly Rooms. I.E.E. (North-Eastern Students' Section). Annual dance.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. "Variable Speed Drives." I. Electrical; by G. B. Alvey. II. Mechanical; by T. Bevan.

Saturday, November 8th

MANCHESTER. — Engineers' Club, Albert Square, 2.30 p.m. E.P.E.A. Northern Meter and Instruments (Technical) Group. "Meter Jewels and Pivots, and Methods of Reconditioning them after service use," by F. Seddon.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1943

GENERAL Electric Co., Ltd., and E. T. Cooke.—" Anti-backlash pinions." 21458. December 22nd, 1943. (593183.)

1944

L. E. Denton.—" Electrically operated step-by-step driving mechanisms." 13727. July 18th, 1944. (593029.)

Allmanna Svenska Elektriska Aktiebolaget.—" Automatic electronic control systems for the regulation of variables." 14337. July 17th, 1943. (593186.)

Marconi's Wireless Telegraph Co., Ltd.—" High-frequency signal-transmitters." 15098. December 29th, 1942. (593137.)

British Thomson-Houston Co., Ltd.—" Casings for centrifugal compressors." 16123. December 2nd, 1942. (593031.) " Filament connections for electric lamps." 19605. October 11th, 1943. (593143.)

Standard Telephones & Cables, Ltd.—" Demodulating arrangements in time modulation electric pulse communication systems." 17229. October 7th, 1942. (593139.) " Thermionic valve frequency multipliers." 17230. July 14th, 1942. (593187.) " Radio navigation apparatus." 22164. February 3rd, 1944. (593080.)

1945

Electrical Engineering & Manufacturing Corporation.—" Stop means for rotating shafts." 1458. November 6th, 1943. (593033.)

Westinghouse Electric International Co.—" Heating of strip metal and the like by electromagnetic induction." 2880. February 5th, 1944. (593195.) " Stability control of alternating current systems." 3211. February 10th, 1944. (593149.)

F. L. Haushalter.—" Method of and apparatus for electrically grounding current conducting members, particularly for track-laying vehicles." 4521. October 9th, 1943. (593038.)

Macfarlane Engineering Co., Ltd., J. W. Macfarlane and W. I. Macfarlane.—" Dynamo-electric generators." 5090. March 1st, 1945. (Addition to 566168.) (593039.)

Standard Telephones & Cables, Ltd.—" Radio time interval measuring system." 6007. March 13th, 1944. (593151.) " Electric pulse modulating circuits." 14072. July 24th, 1944. (593101.)

Philips Lamps, Ltd.—" Electric discharge tubes." 7007. March 24th, 1944. (593198.)

A. Williams and O. E. Meyer, sen.—" Distributor mechanism for electrical ignition devices." 7591. March 26th, 1945. (593089.)

V. I. Little.—" Electronic sense discriminating circuits for control systems." 9764. April 18th, 1945. (593157.)

Londex, Ltd., and J. V. Dossett.—" Electromagnetic relays." 10395. April 25th, 1945. (593094.)

Siemens Bros. & Co., Ltd., and D. P. Long.—" Automatic telephone systems." 11439/40. May 4th, 1945. (593049/50.)

British Thomson-Houston Co., Ltd.—" Poly-N-vinyl carbazole products." 12242. May 15th, 1944. (593097.) " Dynamometers." 13088. May 27th, 1944. (593238.) " Lubricant seals for shafts." 13271. May 27th, 1944. (593255.) " Refrigerating systems." 16249. June 29th, 1944. (593217.)

Creed & Co., Ltd., and F. P. Mason.—" Electric facsimile transmission systems." 12313. May 16th, 1945. (593161.)

Marconi's Wireless Telegraph Co., Ltd.—" Transmission lines." 13062. April 20th, 1944. (593099.)

Standard Telephones & Cables, Ltd., E. C. Fielding, R. W. Lukey, and E. G. Seath.—" Reduction gearing." 13119. May 25th, 1945. (593243.)

A. West & Co., Ltd., and F. W. C. White.—" Electric motor control systems." 13150. May 25th, 1945. (593057.)

English Electric Co., Ltd., and A. R. Mowl.—" Electrical indicating instruments of the attracted iron type." 13182. May 25th, 1945. (593248.)

Western Electric Co., Inc.—" Coupling arrangements for coupling an external circuit to a high-frequency electrical resonant chamber." 13204. April 27th, 1944. (593202.)

Brush Electrical Engineering Co. Ltd., and H. F. Yelland.—" Electrical switchgear." 13217. May 26th, 1945. (593250.)

J. A. Crabtree & Co., Ltd., W. E. Hill and T. D. G. Wintle.—" Electric sockets." 13235. May 26th, 1945. (593252.)

J. Lucas, Ltd., and F. T. Shaw.—" Interlockable electrical plug and socket connections." 13326. May 28th, 1945. (593262.)

J. Lucas, Ltd., and D. A. Jones.—" Machine for performing cutting operations on the commutators of dynamo-electric machines or apparatus." 13466. May 29th, 1945. (593274.)

Standard Telephones & Cables, Ltd., and C. W. Earp.—" Electrical musical instruments." 14283. June 6th, 1945. (593106.)

Heating Installations. Ltd., and W. W. Moore.—" Variable inductance." 14337. June 7th, 1945. (593062.)

J. D. McGee and E. J. Ambrose.—" Electron

discharge devices suitable for television." 14341. June 7th, 1945. (593107.)

Westinghouse Electric International Co.—" X-ray apparatus." 14557. June 15th, 1944. (593115.)

S. A. Quincey.—" Equipment for the protection and safe operation of electrical appliances such as electric motors and the like." 14661. June 9th, 1945. (593066.)

Igranic Electric Co., Ltd.—" Electrical contacts." 14728. June 10th, 1944. (593171.)

Automatic Electric Laboratories, Inc.—" Electromagnetic relays." 14818. June 12th, 1944. (593119.)

Telegraph Condenser Co., Ltd., P. A. Sporing and C. P. Johnson.—" Means for applying metal foil to paper or other insulating material in strip form." 14836. June 12th, 1945. (593174.)

Truvox Engineering Co., Ltd., and H. A. Thilo.—" Electric clocks." 14903. June 12th, 1945. (593122.)

Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges & Camargue.—" Method for the continuous electrolytic oxidation of metallic wires, bands and like parts." 152562. November 9th, 1943. (593207.)

British Thomson-Houston Co., Ltd., L. W. Brown and H. B. Taylor.—" Standing wave detector mechanisms for wave guides." 16151. June 25th, 1945. (593215.)

Metropolitan-Vickers Electrical Co., Ltd., G. A. Geach, L. D. Brownlee and F. E. Bancroft.—" Recording photometers." 17588. July 10th, 1945. (593229.)

General Electric Co., Ltd., and F. J. Keeley.—" Air-blast electrical circuit breakers." 17696. July 11th, 1945. (593230.)

Holophane, Ltd. (Holophane Co., Inc.).—" Light fittings for ceiling designed for acoustical purposes." 18526. July 19th, 1945. (593235.)

Amended Specifications

518277. General Electric Co., Ltd., and others.—" Cathode ray tubes."

558634. Standard Telephones & Cables, Ltd., and another.—" Electrode soldering irons."

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following :—

" ASTRA " refrigerators.

Radio Terms

Confusing Code Names

IN his address as chairman of the Radio Section of the Institution of Electrical Engineers, MR. C. E. STRONG (Standard Telephones & Cables, Ltd.) pointed out that spectacular wartime achievements in radar and radio aids to navigation had revealed wide new vistas for the future.

The application of that fresh knowledge to the needs of to-day was inspiring; but first, to facilitate its orderly application, Mr. Strong believed there was need to rearrange the material and perhaps to overhaul terminology. The art had moved so fast that there had been little chance to sort out the overwhelming flood of systems in an orderly fashion so that they could be appreciated in proper relationship to each other and in true perspective.

A new pattern of classification was needed and some new terms, so Mr. Strong proceeded to consider some of the factors by which systems were distinguished, urging the preservation of a common language for dealing, so far as was possible, with common concepts.

Having classified systems first on broad lines relating to function, he then differentiated further according to technical method employed. Finally he suggested that they should endeavour to find terms for principal methods and so emancipate themselves from the perpetual use of code names of particular systems, which were coined to confuse the enemy and were now tending to confuse everybody.

Trade Marks

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered within one month from October 22nd :—

AUDIX. No. 643,592, Class 9. Electrical instruments and apparatus included in Class 9, and scientific instruments and apparatus.—British Binoculars, Ltd., Sheldrake House, Cobourg Road, London, S.E.5.

FLEXEND. No. B644,642, Class 9. Arc welding electrodes of metal.—Rockweld, Ltd., Commerce Way, Croydon.

VIRITE. No. 651,298, Class 9. Wires (insulated) and cables for transmission systems.—Edison Swan Cables, Ltd., 155, Charing Cross Road, London, W.C.2.

ELECTA (design). No. 644,712, Class 11. Lampshades made of cellulose acetate, paper or parchment.—Electric Art Shades (1928), Ltd., Feering Factory, Feering Hill, Kelvedon, Essex.

STRATALITE. No. 647,798, Class 11. Electrical heating apparatus and electric lamps (not for medical or surgical purposes).—H. Skidmore, A. Phillips and B. Buckley, trading as Strata Engineering Co., 31, Crossbank Street, Oldham.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Blackpool. —November 12th. Electricity Department. Five 400-kVA and one 300-kVA transformers. (See this issue.)

Corby.—November 10th. U.D.C. Three electrically driven 250-gal.-per-min booster pumps, with automatic starting-and gear, electric wiring, etc. G. B. Blackall, clerk, Council Offices, Corby, Northants.

Edinburgh.—November 21st. City Council. Electric passenger/goods lift at Portobello power station. (See this issue.)

Eston.—November 15th. U.D.C. E.h.v. ring main switchgear, l.v. switchgear, one 500-kVA transformer, and e.h.v. and l.v. underground cables. (October 17th.)

Manchester.—November 10th. Electricity Committee. 33-kV cable. (October 24th.)

November 10th. Waterworks Committee. One electrically driven submersible borehole pump. (See this issue.)

Plymouth.—November 1st. Electricity Department. Meters, time switches, underground joint boxes and underground disconnecting boxes. (October 17th.)

Salford.—November 10th. City Council. Electric lighting installation at the Marlborough Road primary school. (October 24th.)

Southampton.—November 14th. Electricity Department. Refrigerators, vacuum cleaners and washing machines. (See this issue.)

West Riding.—November 7th. County Council. Electrical installation in connection with adaptation of buildings at West End Lane, Rossington, for a dental clinic. County architect, Wakefield.

Woolwich.—December 1st. Electricity Department. H.v. and m.v. cables, transformers and meters for the year ending December 31st, 1948. (See this issue.)

Worksop.—Electricity Department. E.h.v. and l.v. cables. (October 24th.)

Orders Placed

Darlington.—Electricity Department. Accepted. Underground disconnecting boxes (£1,979).—W. Lucy & Co.

Docking.—Rural District Council. Accepted. Wiring 110 houses and 18 bungalows (£911).—Barnhams Electrical Co., Walsingham.

Hertfordshire.—County Council. Accepted. 400-kW engine-driven generator for Hill End Hospital (£7,271).—Belliss & Morcom.

Hull.—Corporation. Accepted. Electrical installations in 84 houses at Priory Road West, Hull (£5,896).—Booker & Tarran.

Oldham.—Town Council. Equipment for sodium discharge lighting in Huddersfield Road (£1,304).—G.E.C.

Warrington.—Electricity Committee. Recommended. One 20,000-kW turbo-alternator (with surface condensing plant), electrically driven boiler feed pump and step-up transformers (£147,847) and additional h.p. feed heater in connection with No. 4 extension (£2,110).—English Electric Co. One 200,000 lb per hr boiler unit, extensions to coal conveyor and alterations to boiler house (£188,607), air preheaters for boilers Nos. 1 to 3 (£47,788) and evaporator plant, pipework, transformer cooling pipework and chemical dosing gear (£10,301).—Simon-Carves. 33-kV switchgear for No. 4 turbo-alternator (£11,160) and switchgear for a new factory (£3,307).—Ferguson, Pailin. Fire protection equipment.—Mather & Platt. 33-kV and 66-kV cables for No. 4 turbo-alternator (£1,532).—B.I. Callender's Cables. Boiler control board, additional air heater panels for Nos. 1, 2 and 3 boilers, and provision of phase failure protection for fan and feed pump motors (£5,033).—Brookhirst Switchgear.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alfreton.—Factory, Nix's Hill, for Cellular Clothing Co., Ltd., Old Basford; W. V. Betts & Son, 2, St. Peter's Church Walk, Nottingham.

Alnwick.—Houses (50); U.D.C. surveyor, Council Offices.

Banbury.—College of further education; G. R. Hutton, county architect, Oxford.

Bristol.—Three-storey offices, Bathurst, for Port of Bristol Authority; C. A. Hayes & Sons, Ltd., builders, Stork House, Hotwells, Bristol, 8.

Cardiff.—Factory, Western Avenue, for British Plimber, Ltd., 90, Regent Street, W.1; Willmott & Robertson, 51, Charles Street.

Chesterfield.—Factory, Sheffield Road, for Disabled Persons Employment Corpn., Ltd., 25, Buckingham Gate, S.W.1.

Chigwell.—County primary school, Grange Hill (£104,250), for Essex C.C.; Gilbert Ash, Ltd., builders, Stanhope Gate, London, W.1.

Clyde. — Extensions, Lancefield Quay (£49,568), for Clyde Navigation Trust; W. Baird & Son, Ltd., contractors.

Guisborough (Yorks).—Shirt factory; Kitching & Co., 21, Albert Road, Middlesbrough.

Haverfordwest.—Extensions to factory for Dried Milk Products, Ltd., Merlins Bridge.

Hendon.—Laboratories and offices, Hill View Gardens, N.W.4, for the British Launderers' Research Association; Riches & Blythin, architects, 9, King's Bench Walk, Temple, London, E.C.4.

Lewisham.—Extensions to works of Riddle, Smith & Duffus, Ltd., Stanstead Road; Sir John Brown, A. E. Henson & Partners, 117, Sloane Street, S.W.3.

Margate.—Factory premises, Ramsgate Road industrial site; Shaw & Lloyd, 74, Gt. Russell Street, London, W.C.1.

Nantwich.—Agricultural technical school, Pool Hall; E. M. Parkes, county architect, The Castle, Chester.

Newcastle-on-Tyne.—Factory and offices, Glasshouse Street, for British Engines, Ltd.; R. Bowey, builder, Back Raby Street.

Ice cream factory, Seaham Street; Page, Son & Hill, architects, 75, King Street, South Shields.

Oxford.—Additions to Oxford and District Eye Hospital, Walton Street; H. H. Clark, Victoria House, Queen Victoria Street, Reading.

Rochdale.—Houses (48), Low Farm, Smallbridge; Thos. Fitton & Sons, builders, Louisa Street, Rochdale.

Romford.—Out-patients' department, County Hospital; J. Connolly, county architect, County Hall, Chelmsford.

Sheffield.—Extensions to works and offices, Carlisle Street and Carwood Road; Thomas Firth & John Brown, Ltd.

Standish.—Pit-head baths, Victoria Colliery, for Miners' Welfare Commission; C. G. Kemp, architect, 5, Old Queen Street, Westminster, S.W.1.

Sutton Coldfield.—Television transmitting station for the B.B.C.; L. Rome Guthrie, architect, 61, South Molton Street, London, W.1.

Swansea.—Factory, Gors Road, for Disabled Persons' Employment Corpn., Ltd., 25, Buckingham Gate, London, S.W.1.

Works and offices for Welsh Glass Works, Ltd., Fisher Street; Henry A. Ellis & Son, 6, Wind Street.

Tattingstone (Suffolk).—Nurses' home, and alterations to St. Mary's Hospital (£34,120); East Suffolk county architect, Burlington Road, Ipswich.

Urmston.—Houses (39) and flats, Flixton, for U.D.C.; J. Maunders & Sons, Ltd., builders, 554, Barton Road, Stretford.

Wallsend.—New factory for Doig Bros.; Matkin & Hawkins, architects, Barclays Chambers, Fawcett Street, Sunderland.

Walsall.—Extensions to factory for Wilmot Breeden, Ltd., Eastern Works, Camden Street.

Factory for J. Dixon Tool Co., Bott Lane.

Walthamstow.—New works, Blackhorse Lane, for Ford Motor Co., Ltd., Dagenham; T. A. McInery, staff architect.

Warrington.—Houses (122), Hollows Avenue; Tomlinson & Norbury, builders, Orford Green.

Wembley.—Extensions to factory for Fishers Foils, Ltd., 7, Exhibition Grounds; L. C. Norton, 16, Clifford Street, London, W.1.

Extensions to factory for Base Metal Products, Ltd., North End Road; Nicholls & Hall, architects, 66a, Wigmore Street, London, W.1.

Lighting Developments

"The Gas Arc" Demonstrated

THE gradual development of the electric lamp was indicated by DR. J. N. ALDINGTON (Siemens research laboratories, Preston) in a lecture to the Liverpool Section of the Illuminating Engineering Society in the Corporation showrooms last week.

Stages of evolution of the discharge tube were described with reference to fundamental research into emission phenomena which led to the introduction of the hot-cathode lamp. But the possibilities of the cold-cathode tube had by no means been exhausted and, after the lapse of some years, the scope for research had been further extended by the study in the Siemens laboratories of flash discharge and heavy current arc conditions in some of the rare gases.

The results had been translated by Dr. Aldington into a practical form of light source termed "the gas arc," representing another stage in the continuous evolutionary process. But it appeared to be a distinct step forward, since a 10-kW lamp of this kind measured only 2 by 20 cm, being essentially a low-voltage large-current device. Complex atomic and temperature effects caused dominant continuous emission, additional to the characteristic spectrum of the rare-gas filling, the colour being very close to that of daylight. The flux emitted by one type, which was water cooled, contained very little heat radiation.

Flash discharge lamps of this kind were employed to assist the photographing of enemy territory from aircraft before the invasion of the Normandy Coast and subsequent development had resulted in eight types of this kind of lamp becoming available for high-speed photography, as used in University research investigations.

Later still Dr. Aldington set himself the task of making such a tube emit light continuously, one of which he demonstrated "for the first time in public" during his lecture. The "daylight" radiated was caused by continuous excitation of zennon gas "to a higher order than ever achieved before."